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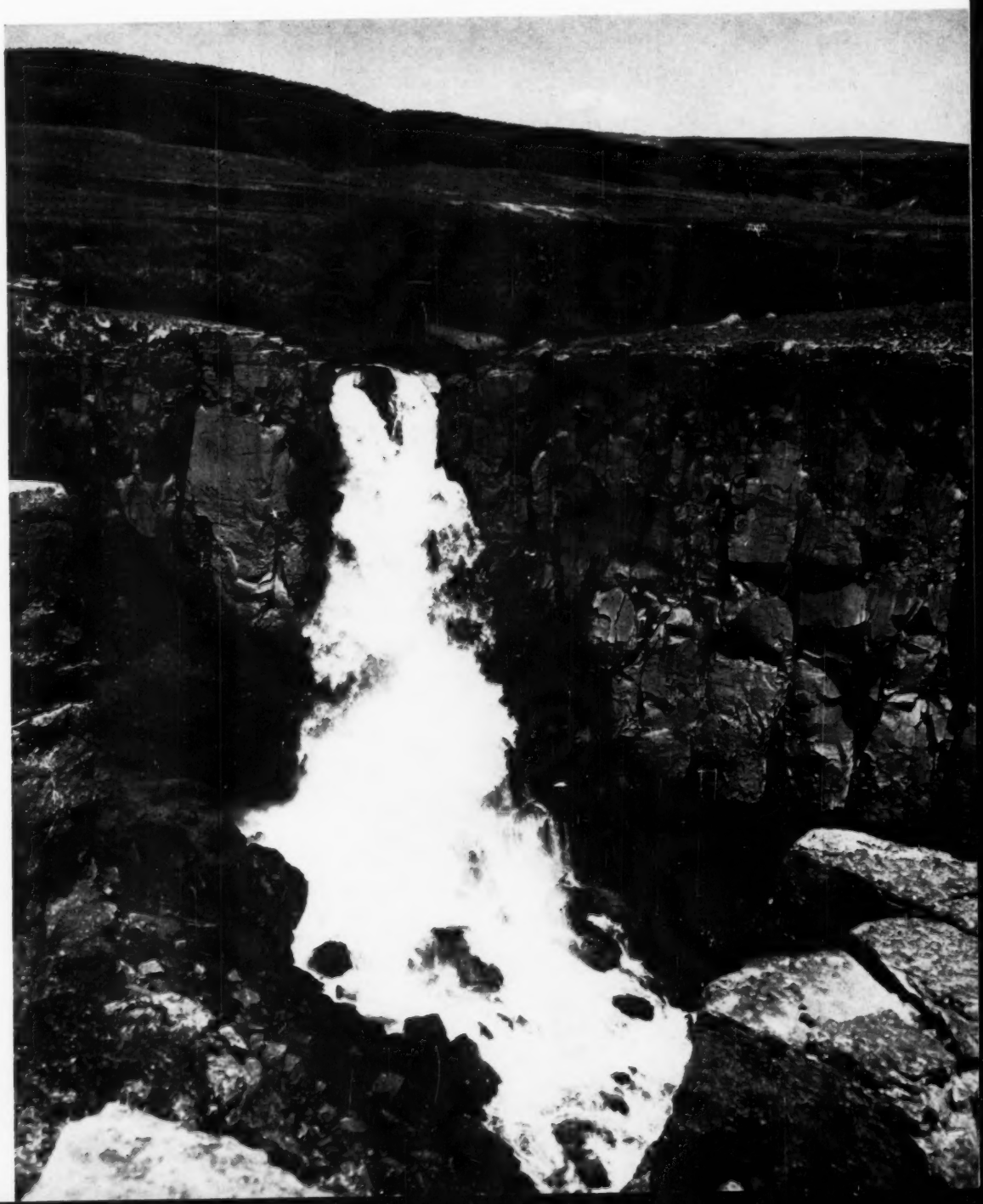

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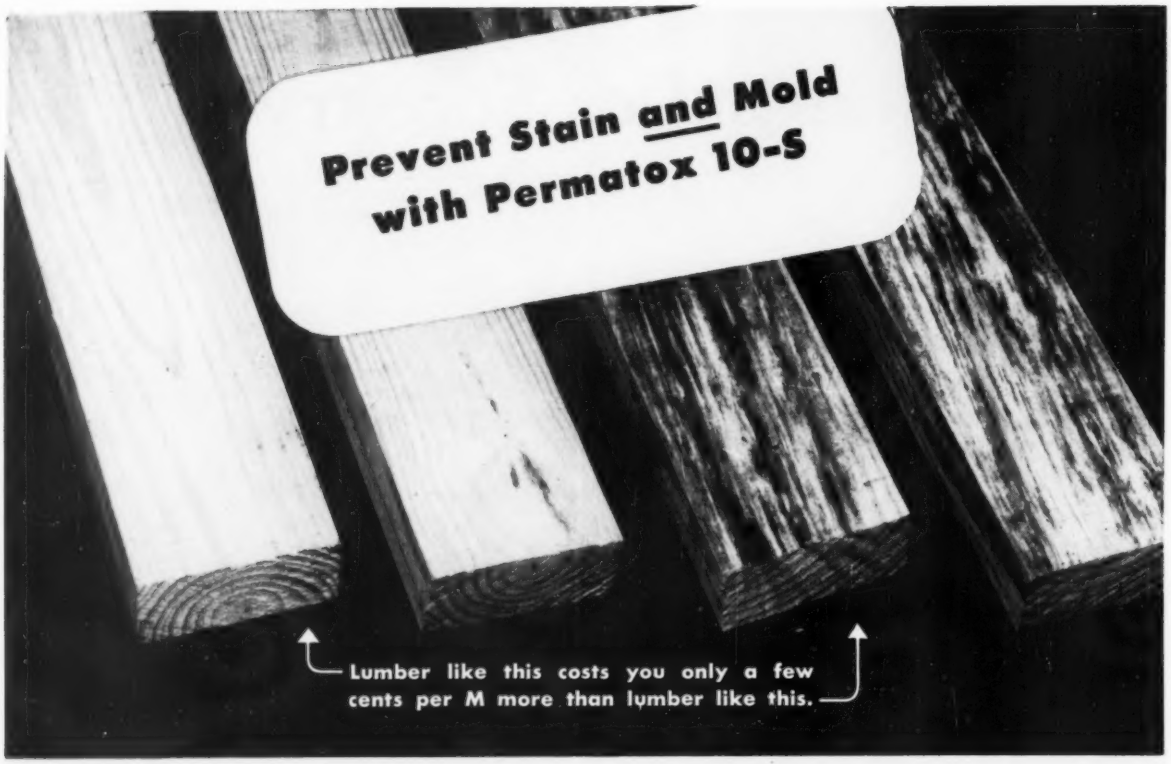

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Journal of Forestry

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Problems Facing Forest Management in the Central Rocky Mountains[1]

Jesse H. Buell

Forester, Rocky Mountain Forest & Range Experiment Station, Fort Collins, Colo.[2]

WITHOUT THE ROCKY MOUNTAINS the Central Rocky Mountain region would be without moisture, left high on a windswept plain too dry for anything but cactus and sagebrush. West of a line running near the eastern borders of the Dakotas, Nebraska, and Kansas, and splitting Oklahoma and Texas, potential evapo-transpiration exceeds precipitation—that is, lack of rain limits plant growth. The dryness deepens as you go farther west and does not let up until you are almost within shouting distance of the Pacific. Nowhere in the Central Rocky Mountain region, except in the mountains, is the annual precipitation more than 20 inches; in much of it, it is less than 15 inches; and in places, as low as 4 or 5. It is hard for the newcomer to realize how different this region is from the lush east. Home grounds here are verdant and shaded, and at first one does not notice the lawn sprinklers incessantly spraying.

But listen to a paragraph or two of what Bernard De Voto[3] said to a graduating class at the University of Colorado a few years ago:

> We are desert-dwellers. The West is a desert. Colorado is a desert. A human society more complex than that of small migratory herders of sheep and cattle, a civilization higher than that of the Indian hunters who preceded us here, is possible only because of the snow that falls upon our peaks. We can meet here today, there are lawns on this campus, there is a University of Colorado, there is Boulder, there is Denver only because the stone fingers of the Rockies reach up to catch and hold the snow. We Westerners have carried the United States beyond the line where rain for crops falls off, where logic and the experience of the Americans said civilization must stop, and we have maintained our society here, only because our land has mountains and water runs downhill. The West is a desert, and we have told ourselves, and God knows we have told the world, that we have made the desert blossom as the rose. We are telling the plain truth. But we would be wise to remember every moment that roses also blossomed in Mesopotamia and Syria and Tunis and Ur of the Chaldees—and they are desert wastes now.

As De Voto says, the mountains are our relief. About them are coolness and moisture. Between the summit of Pikes Peak and the eastern edge of Colorado mean annual temperatures differ as much as between Iceland and Florida.[4] Rainfall in a valley may be 6 inches a year, and in the mountains less than 30 miles away, more than five times as much.[5]

Only in the mountains — little more than 10 percent of our area— are forests and natural vegetation. Elsewhere extraordinary pains must be taken to make trees grow for windbreaks, shelterbelts, and shade, and in many places they cannot be grown at all, except under irrigation.

The Forest Area

Our natural forests are confined to the mountains that rise high enough to cool the moisture-laden winds and wring from them a sufficient precipitation. They are grouped into islands. The lower lands that interlace and encircle them are grass or brush covered. Mountain peaks at the centers of some of the forest-islands rise so high that their tops are treeless because of the cold. That is to say, we have two timber-lines. The lower one, due to lack of moisture, is at about 3,000 feet in South Dakota, and 6,000 feet farther south. The upper one, due to cold, is reached only in the main mass of the Central Rockies where the mountains reach above the critical elevation of 11,000 feet, more or less. So our forests form a ribbon some 5,000 feet deep vertically around the slopes of the mountains.

It is a striped ribbon. The top stripe, next to the alpine tundras, is spruce-fir forests. Just below is a zone of lodgepole pine, broad toward the north but pinching out this side of the New Mexico line. The next band is ponderosa pine. At the south it spreads out to take over where lodgepole pine stopped. Following along the foothills to the north, skipping here and there, it widens again to form the forests of the Black Hills in South Dakota. From the Black Hills down to middle Colorado, ponderosa pine borders the brush and grasslands of the valleys and plains. Farther south, a belt of pinyon-juniper woodland is the bottom stripe.

Commercial Species and Types

Our important commercial species can be counted on the fingers of one hand: Englemann spruce, subalpine fir, lodgepole pine, ponderosa pine, and Douglas-fir. Locally aspen is used for matches and excelsior, and everywhere is a big tourist attraction when the leaves turn gold in autumn. Minor species include blue spruce, white fir, lim-

[1]Paper delivered at the general meeting, 53rd annual meeting, S.A.F., Colorado Springs, Colo., Sept., 1953.

[2]Maintained by Forest Service, U. S. Dept. Agric., in cooperation with Colorado A & M College.

[3]De Voto, Bernard. The desert threat. Univ. Colo. Bull. 48, No. 18. Boulder, Colorado. 1948.

[4]U. S. Department of Agriculture. Climate and man. Yearbook of Agriculture, p. 807. 1941.

[5]U. S. Department of Agriculture. Climate and man. Yearbook of Agriculture, p. 798. 1941.

ber, bristlecone, and pinyon pines, junipers, cottonwoods, and willows.

Engelmann spruce-subalpine fir is a climax type, behaving here very much as spruce-fir types do throughout the continent; in fact, Oosting[6], comparing spruce-fir stands of the Medicine Bow Mountains in Wyoming with those of the Southern Appalachians, commented that they were so much alike that they smell and sound the same. Lodgepole pine is a pioneer type reproducing in dense even-age stands following major disturbances of the forest. It is not a climax, but acts like one where fire eliminates its competitors. In this regard it is much like the southern pines. Ponderosa pine is probably climax, although, in the Black Hills at least, it often reproduces in dense even-aged stands over large areas following fire or windthrow. Douglas-fir has been little studied in this region, and its place in succession is not well known. As a type, it is not extensive or important compared to the others.

We have no exact figures on the acreages, volumes, or rates of growth of our timber. The Forest Survey has not yet covered Wyoming, Colorado, or Nebraska, and the original surveys of South Dakota and Kansas are 15 years old. Forest Service reappraisal figures for 1945 showed a stand of 44 billion board feet on 14 million acres of commercial forest land in Region 2 (Colorado, Wyoming east of the Continental Divide, South Dakota, Nebraska, and Kansas). Annual growth was estimated at 365 million board feet for the region. Average growth computed from these data is 26 board feet per acre per year. This low figure is due in part to the fact that nearly one-third of the area was classed as virgin. However, the growing season is short at high elevations—at Fraser, near the Rocky Mountain Station's experimental forest, the frost-free period averages only 17 days a year. So we can hardly expect better than 100 to 150 board feet per acre per year for managed stands in the mountains.

Our timbers are not large. Mature spruce-fir stands may have a few trees 3 feet in diameter, but trees 2 feet and less are commoner. Heights rarely run over five 16-foot logs; three being more usual. Lodgepole pine is typically straight and slender. Mature trees may be 2 feet in diameter, but are usually less than 18 inches and run to three or four logs. Ponderosa pine in the old-growth stands of southern Colorado may go to 48 inches in diameter and six logs in height, but in the Black Hills where much of the larger virgin stuff has been cut, 28-inch four-log trees are big.

Ours is not a region of large clear trees of rapid growth. In managed stands on rotations of from 100 to 200 years, medium-sized and somewhat knotty trees are probably the best that we can grow.

Forest Economics

Dendroctonus engelmanni killed 4 billion board feet of Engelmann spruce in the high mesa country of Colorado between 1939 and 1952. We have other, but less dramatic, natural enemies of the forest: *Dendroctonus ponderosae* in our ponderosa pine, mistletoe in the lodgepole, and porcupines and wind indiscriminately, among them. Because most of our forests are filled with snow half the year and are moistened by mountain showers during the summer, fire is not so troublesome here as it is elsewhere.

Forest Economies

In the Central Rockies we are just growing out of the pioneering stage. Our forest economies are certainly frontier economies. Ours is probably the last frontier forest in the United States. In the westward migration the Rocky Mountains were barriers to be passed over. Their forests were too inaccessible and too puny to be used except as a source of ties and fuel along the way for railroads pushing to the Pacific; certainly too insignificant to attract a lumber industry dazzled by the big trees of Oregon and Washington, and California. Even the forests of Alaska are ahead of us now, for they are getting pulpmills. But we shall have our day.

Our forests grow on steep land, snow-bound much of the year. Not only are they remote in the mountains, but are difficult and costly to log once they are reached by roads. Our logging and milling are very generally of the kind common to operations just on the edge of feasibility. Consequently, so much of our lumber is poorly sawn and dried that all local lumber is considered inferior here at home and has a hard time competing with lumber inherently no better, shipped in from areas whose large mills produce uniform, well-turned-out stuff.

Our annual cut of lumber now is about 200 million board feet. The growth of our forests, estimated at 365 million a year, could be doubled under more intensive forest management. So it is obvious that we are cutting far below sustained-yield capacity. A great deal of our lumber is mature before it reaches sawtimber size; many more stands could be improved by thinnings that would take out 4-, 6-, and 8-inch trees; finally our 4 billion feet of standing dead spruce has checked too badly to be used for lumber, but predictions are that it will be good for pulp for 30 years. So you can see we are ready for a brisk market in small products—ties, posts, poles, and pulpwood. I am confident it will come—eventually.

Most of our forest land is more valuable to the economy of the region for the water it yields than for its timber products. Mr. De Voto's warning is not to be forgotten. But in our high mountains most of the precipitation is snow. In dense coniferous forests a good share is held on the tree branches and is lost by evaporation into the air. Here timber cutting may actually increase water yield. The trick is to cut and log without increasing erosion or decreasing the absorptive power of the soil.

Recreation must not be overlooked, either. There is no great conflict between timber harvesting

[6]Oosting, H. J. and J. F. Reed. Virgin spruce-fir of the Medicine Bow Mountains, Wyo. Ecological Monographs 22: 69-91. 1952.

and recreation yet, but good planning will certainly be needed to avoid it in the future.

Problems of Management

What, then are the problems facing forest management in the Central Rocky Mountains? In spruce-fir, here as elsewhere, we have a controversy over even-aged management versus all-age management. In our overmature old growth there is little choice but to make the first cutting a patch or strip clear-cutting. But how wide a patch will seed in and reproduce adequately? If slash needs to be gotten rid of to decrease fire hazard, how can it be done with least harm silviculturally?

Clear-cutting seems to suit lodgepole pine best, but what can we do to avoid too-dense reproduction? And what is the best schedule of intermediate cutting to keep the new stand growing?

Ponderosa, especially on national forests in the Black Hills, has been under management for 50 years. Now we are ready to use more intensive silviculture. The shelterwood system is to be tried, and problems of its application will need to be solved.

As for the shelterbelts, there is some question whether the first-priority problems are in the field of forest influences or of arboriculture. After all lingering doubts of the effectiveness of shelterbelts have been allayed, there will be plenty of questions about species, spacing and arrangement, nursery and planting practices, and plantation management.

Then, there is the continuing problem of forest protection: from wind, fire, insects, and diseases. And always before us is the necessity of handling our forests so as to maintain or enhance the yield of good water from them.

We need an inventory of our forest resources. Without it we can do no accurate planning.

But since we manage forests only so that the trees may be used, our most important problems are in the field of forest products utilization. How can we improve logging and milling methods so that we shall have good lumber to sell at reasonable prices? How can we develop new uses for our particular kinds and sizes of trees? The really big question is, of course, how shall we attract the markets?

Conclusion

I feel sure that the forests of the Central Rockies will in the future increase in importance as producers of timber. The many changes since the days when our accessible timber was passed up and despised, and the high-mountain forests were thought to be as remote as the moon, point to more changes to come. We are a fast-growing region. Only the Pacific Coast states, and two or three in the East, have beat the Central Rocky States in population increase over the last decade.[7] Outside our region, timber is getting scarcer all the time.

Let us improve our logging and milling methods and our silviculture, and we can supply most of our own lumber needs. Over and above that we shall certainly be able to grow a continuing supply of pulpwood and small products for processing here, or for export, as economies may dictate. So I say, give us time, and forest management in this region will come into its own.

[7] U. S. Department of Commerce, Bureau of the Census. Statistical abstract of the United States, 1951. p. 4. 1951.

Correction

"Effect of Pruning on Western Red Rot in Young Ponderosa Pine in the Southwest," by Stuart R. Andrews, Jour. Forestry, Vol. 52, No. 1, pp. 33-38 (January 1954).

Table 2: Change "7" to 70 for "Tight knot", 60-year age class, "Unpruned in 1939", Positive pct".

Table 3: Change "14" to 30 and "31" to 47 for the totals under the "Negative" and "Total" columns for the 60-year age class.

Growth and Mortality in an Old-Field Southern Pine Stand

Sam Guttenberg
Southern Forest Experiment Station,[1] New Orleans.

This article compares the effects of several cutting treatments in a dense old-field stand of loblolly and shortleaf pine. It demonstrates that such stands are capable of good response, even when they are well past the age at which the first thinning for sawlog production should be made.

A DENSE old-field stand of 80 percent loblolly and 20 percent shortleaf pine has been under observation for the past 15 years on the Crossett Experimental Forest in south Arkansas. In 1937, when it was 44 years old, it was variously thinned in an effort to estimate the effect of different intensities of thinning on growth, yield, crown development, seed production, and regeneration.

Treatments

The basal area and number of trees on the study area prior to treatment are shown in Table 1. Though the plots are contiguous, site index varies from 72 to 95; the average for the A series of plots is 78 and that for the B series 89. Yield tables for loblolly pine indicate that, at age 44, fully stocked stands on such sites contain from 153 to 166 square feet of basal area and from 230 to 350 trees per acre.[2] Thus, the study stands were fairly close to full stocking. However, many of the trees were very rough, or had redheart, poor form, or other defects that disqualified them as sawlog growing stock. Furthermore, the ratio of live crown to tree height—usually considered a critical point in assessing vigor—was less than 30 percent on the average dominant tree.

Six treatments were applied, with two 1-acre plots assigned to each. The first four treatments aimed at reducing the stand to 200, 100, 70, and 40 crop trees per acre in such a way that no crop trees would be closer than 15, 21, 25, or 33 feet. The fifth treatment was a diameter-limit cutting in which seed trees larger than 9.5 inches in d.b.h. were left at intervals averaging 50 feet, and all trees smaller than 7.5 inches were also left. The sixth treatment was an uncut check. For two reasons, however, the four spacing treatments were not rigidly followed. First, some

TABLE 1.—STAND[1] PER ACRE BEFORE CUTTING, 1937 (AT AGE 44 YEARS)

Plot	Original number of trees	Original basal area	Treatment subsequently assigned[2]
		Square feet	
1A	412	123.7	Best 200 trees
1B	270	147.2	
2A	384	142.4	Best 100 trees
2B	226	121.3	
3A	312	155.7	Best 70 trees
3B	218	145.1	
4A	332	129.8	Best 40 trees
4B	228	146.8	
5A	364	137.2	Diameter-limit
5B	224	142.5	
6A	464	135.0	No cutting
6B	188	152.7	

[1]Trees larger than 3.5 inches d.b.h.
[2]See text for explanation of treatments.

[1]Forest Service, U. S. Dept. Agric.

[2]Volume, yield, and stand tables for second-growth southern pines. U. S. Dept. Agric. Misc. Pub. 50, 202 pp. 1929.

TABLE 2.—STAND PER ACRE, 1937 AND 1952

Plot	Trees[1]		Basal area[1]		D.b.h. of trees of av. basal area[1]		Cubic volume[1]		Saw-timber volume[2]	
	Left in 1937	Alive in 1952	Left in 1937	Alive in 1952	Left in 1937	Alive in 1952	Left in 1937	Alive in 1952	Left in 1937	Alive in 1952
	Number		*Square feet*		*Inches*		*Cubic feet*		*Board feet*	
1A[3]	180	118	67.9	82.9	8.3	11.4	1,810	2,539	3,372	10,374
1B[3]	134	92	85.6	93.7	10.8	13.7	2,562	2,992	9,202	14,478
2A	98	78	45.2	72.1	9.2	13.0	1,296	2,344	3,314	10,832
2B	86	68	60.9	86.6	11.4	15.3	1,866	2,790	7,756	14,704
3A	72	54	36.2	60.4	9.6	14.3	1,040	1,958	3,112	9,754
3B	66	52	66.2	86.8	13.6	17.5	2,156	2,815	10,500	16,146
4A	86	42	28.2	41.3	7.8	13.4	720	1,342	1,272	6,382
4B	58	44	46.1	58.8	12.1	15.6	1,460	1,910	5,960	10,158
5A	206	102	52.6	60.7	6.8	10.4	1,194	1,775	1,472	5,972
5B	48	24	22.6	25.6	9.5	14.0	676	827	2,262	3,992
6A	464	270	135.0	133.6	7.3	9.5	3,272	3,758	3,770	11,320
6B	188	136	152.7	153.8	12.2	14.4	4,776	4,956	20,548	25,046

[1]All trees larger than 3.5 inches in d.b.h.; cubic volumes include wood to a merchantable top at least 3.5 inches in diameter inside bark.

[2]International rule with ¼ inch kerf. Includes all trees larger than 9.5 inches d.b.h., utilized to a minimum top diameter of 7.5 inches inside bark.

[3]The 1952 stand on plots 1A and 1B has been reduced not only by mortality but by intermediate thinnings as follows:

Plot 1A: 40 trees; 20.1 square feet basal area; 565 cubic feet; 1,628 board feet.
Plot 1B: 36 trees; 25.3 square feet basal area; 796 cubic feet; 2,818 board feet.

plots lacked desirable crop trees at the required spacing. Second, in addition to the specified number of crop trees, some plots were allowed to retain trees too small for pulpwood (less than 5½ inches d.b.h.) where no interference with crop trees was indicated.

The residual stands are described in Table 2. Plots 1A and 1B were rethinned at 5-year intervals after 1937 to basal areas ranging from 63 to 83 square feet per acre. All other plots received only the initial treatment.

TABLE 3.—PERIODIC NET ANNUAL GROWTH AND MORTALITY PER ACRE, 1937 TO 1952

Plot	Total change		Saw timber change	
	Net growth	Mortality	Net growth	Mortality
	Cubic feet		*Board feet*	
1A	86[1]	6.1	575[1]	0
1B	82[1]	5.2	540[1]	18.3
2A	70	13.7	501	37.3
2B	61	14.1	463	39.3
3A	61	7.6	443	0
3B	44	22.2	376	97.0
4A	41	14.3	341	7.0
4B	30	21.5	280	92.7
5A	39	30.7	300	0
5B	10	15.4	115	28.7
6A	32	50.5	503	0
6B	12	49.3	300	125.7

[1]Includes the yield from thinnings in 1942 and 1947.

Response

Though not necessarily optimum, plots 1A and 1B have proved superior by most criteria. Periodic net growth (including ingrowth) has averaged over 500 board feet per acre per year, and the intermediate thinnings have kept mortality low. If maximum periodic net annual increment had been the chief goal, the best stocking might have been somewhat greater than that of plot 1A, but not so high as on the unthinned check plots 6A and 6B.

Plotting the growth response against basal area, as is done in Figure 1, suggests that a modest amount of basal area will sustain good growth. Figure 1 shows better growth on the poor sites than on the good; this may be attributable to the greater ingrowth occurring on the poor sites.

Except on suppressed trees, crown development has been surprisingly rapid (Fig. 2). There was a marked improvement in the crowns of dominant and codominant trees on all thinned plots in the first three years; some improvement was noticeable even in the first season after thinning. About one-fourth of the intermediate trees made substantial gains in crown quality in the first five years after thinning. Generally speaking, the crowns of suppressed trees did not respond favorably.

Cone production largely paralled crown development. A bumper seed year occurred during 1939.

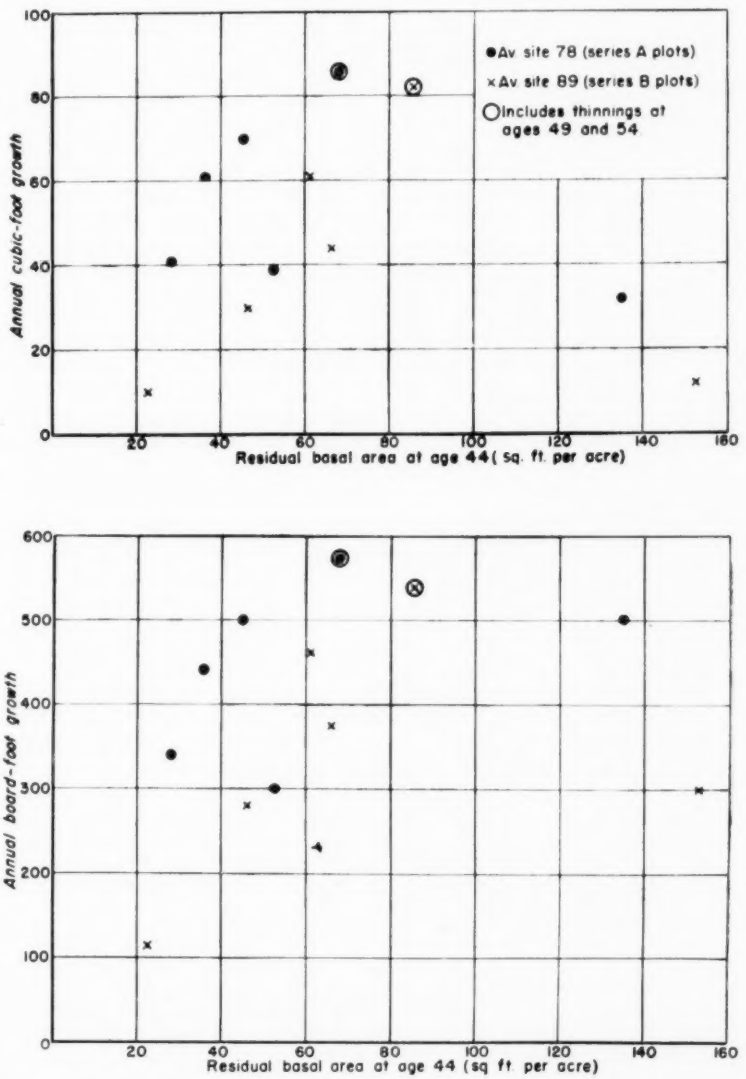
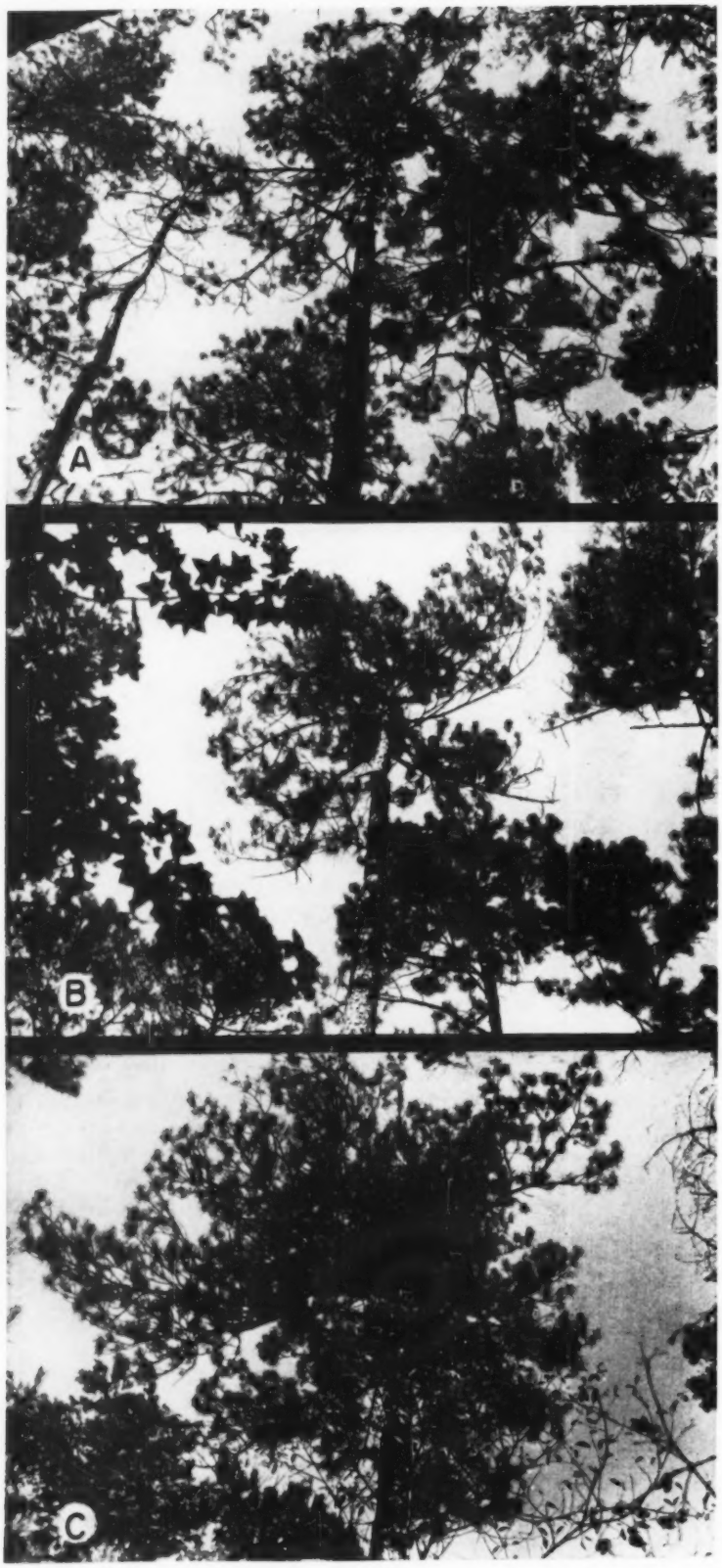

●Av site 78 (series A plots)
×Av site 89 (series B plots)
○Includes thinnings at ages 49 and 54
Annual cubic-foot growth
Residual basal area at age 44 (sq. ft. per acre)
Annual board-foot growth
Residual basal area at age 44 (sq ft per acre)

FIG. 1.—Periodic net annual growth per acre in a dense old-field stand of loblolly-shortleaf pine in south Arkansas. This stand was first thinned at age 44, and annual growth is the average for a 15-year period after this thinning.



This was only three growing seasons after release, yet the crowns of the dominant and codominant trees on all but the check plots and plots 1A and 1B had developed sufficiently to produce a good cone crop. In 1951, another heavy seed year, cone production was still notably lacking on the check plots, sparse on plots 1A and 1B, but abundant on all other plots. Of course, it is usually immaterial whether reproduction follows intermediate thinnings.

Annual mortality on the uncut plots averaged 49.9 cubic feet per acre, while that on the thinned plots was 15.1 cubic feet (Table 3).

On thinned plots, 91 percent of the loss was in intermediate and suppressed trees. Of the total mortality on these plots, 59 percent was caused by ice storms and 28 percent by suppression. On the check plots, 89 percent of the dead trees were the victims of suppression and only 8 percent succumbed to ice damage. Losses from windthrow, lightning, insects, and other causes were negligible.

It seems evident from these plots that when thinning is to be done in comparably dense, relatively old, even-aged stands, the leaving of very small-crowned, whippy trees unprotected by an overstory tree will invite ice damage. It is also apparent that old and badly suppressed old-field trees should not be retained for growing stock—expectation of loss is high and growth is negligible.

FIG. 2.—Crowns of old field loblolly pine at age 59, fifteen years after thinning study began. *A:* Unthinned check plot. *B* and *C:* Dominant crowns on plots thinned, respectively, to 200 and to 40 of the best trees per acre. (U. S. Forest Service photos.)

Estimating the Quantity of Tree Foliage in Oak Stands in the Tennessee Valley[1]

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THE INFLUENCE OF forest cover on site depends in part on the quantity of foliage produced. The crown canopy largely determines variations found in the interception, evaporation, and transpiration of moisture. The forest litter, made up mostly of decomposing leaves, influences the infiltration and evaporation of soil moisture. Investigations now underway in the Tennessee Valley are concerned with these factors as they contribute to the productivity of site and the quantity and quality of water yield from forests. A special study was made to obtain definite knowledge on the quantity and kind of foliage in a one-acre stand of irregular, second-growth, mixed oak forest. Presented here is a tested technique for estimating foliage of forest cover; also quantitative information on the foliage of the sample acre.

Kittredge has summarized the current state of knowledge of quantitative variations of foliage for forest trees and stands (*6*). Considerable work has been done, but little of the published information applied directly to the second-growth upland oak forests of southeastern United States. Quantity of foliage has been reported by number, weight, area, and volume, all of which are closely correlated. For individual trees quantity has been determined both by sampling and by intensive study of total foliage (*2, 3, 4, 5, 11*). For forest stands, total quantity of leaves is generally estimated indirectly, but on several small areas direct measurement has been made (*1*). By one technique, total leaf surface was calculated from the quantity of lead arsenate spray retained on the foliage (*9*). In another study collection of a sample of the leaf fall has served as a basis for estimating hardwood leaf quantity. Statistical analysis has shown a highly significant relation between branch diameter squared and number of leaves (*5*), and a logarithmic relationship between leaf weight and tree diameter (*7*).

TABLE 1.—OAK STANDS FROM WHICH LEAF SAMPLES WERE COLLECTED

Stand number	Location	Site Quality	Description
1	Clear Creek Forest Experimental Area, Anderson County, Tenn.	Fair	Stand cut over and subjected to fire and grazing prior to 1934. Well drained western slope in Great Appalachian Valley. Soil is Clarksville cherty silt loam, of dolomitic limestone origin.
2	Norris, Anderson County, Tenn.	Good	Well-stocked sawtimber stand on ridge in Great Appalachian Valley. Soil is Clarksville cherty silt loam, of dolomitic limestone origin.
3	Crossville, Cumberland County, Tenn.	Poor	Poorly-stocked sawtimber stand depleted by past cutting, burning, and grazing on Cumberland Plateau. Soil of Hartsells-Muskingum group, sandstone origin.
4	Blue Ridge, Fannin County, Ga.	Good	Well-stocked stand on slope above cove in Appalachian Mountains. Soil of Fannin-Talladega-Chandler group, derived from schists.
5	Natchez Trace State Forest Park, Henderson County, Tenn.	Poor	Stand subjected to fire, grazing, and erosion prior to 1933 in Western Highland Rim. Soil is Gulf Coastal Plain sandy clay of Susquehanna-Savannah-Ruston group.

Method of Study

In this study we set out to determine the relation between quantity of foliage and tree diameter. Such relationships would permit the use of stand tables as a basis for estimating foliage.

Our field measurements were taken in the stands of mixed oak described in Table 1. Most of the work was done in Stand No. 1, the sample acre used in the Clear Creek transpiration study (*10*). To extend the applicability of any results, we also sampled four other locations. Stands 2 and 3 provide contrast in site quality, Stands 4 and 5 in geographic location.

In Stand 1, we selected sample trees to represent the diameter distribution of all major species; in the other stands we sampled only white, black and scarlet oaks. Badly deformed trees, such as those with dead or broken tops, were excluded from the sampling. The species, d.b.h. and crown class were recorded for each sample tree. The trees were climbed; branches were numbered consecutively and the numbers were tallied by upper and lower crown portion and by branch size: less than ¼ inch, ¼ to ½ inch, and by ½-inch class intervals for larger branches. Sample branch numbers were then selected at random,[3] the branches were identified, and then cut from the tree.

Diameter of the sample branches was measured to the nearest tenth inch, and the leaves were counted.

[1]Recognition is due to W. H. Cummings, chief, T.V.A. Forest Management Investigations Section, Forestry Investigations Branch, for his assistance in planning and conduct of the study, and to other personnel of the Division of Forestry Relations for their assistance in measuring leaf area.

[2]Respectively, forester, forestry aide, and statistical clerk.

[3]To assure good distribution of branch size in the sampling, all branches were stratified in diameter classes of less than ½, ½ to 1½, and 1½ to 2½ inches. In each of these three classes about one-sixth of the branches were randomly selected as samples. In the case of limbs over 2½ inches in diameter, the component branches were classed as above, but only about one-twelfth of each class were selected as samples.

Five percent of the total leaves, or a minimum of eight leaves, was collected from each sample branch. These were brought into the office where eight leaves were selected at random for each branch.[4] The leaf area of each sample was planimetered and the sample was oven-dried and weighed.

On the pines, sample branches were selected in the same way as from the hardwoods. After the selected branch was cut from the tree, the twigs were cut from the main stem and separated into the following diameter classes: less than 0.15, 0.15 to 0.25, and 0.26 to 0.35 inch. Random twigs were selected from each class and brought into the office for a count of fascicles and for measurement of leaf area.

To determine the leaf surface area on shortleaf pine, a microscopic examination was made[5] of sections from a number of needles. These measurements revealed that each needle approximates a half cylinder in cross-section having a ratio of arc (outside surface of the needle) to width (inside face of the needle) of 1.6435. Since all surfaces of the needles of shortleaf pine bear stomata, the total surface for a typical 2-needle fascicle is: $A = 2(W + 1.6435\ W) \times L$ where A is the surface area, W is the average width, and L the average length of the two needles.

Stand 1 was sampled three times in each of two growing seasons (1948 and 1949): early season, May and June; mid-season, July and August; and late season, September and October. Average leaf areas and weights for the principal species for each sampling period are given in Table 2. The other stands were sampled in the fall of 1948.

Analysis

Preliminary plotting of the number of leaves by branch diameter showed an expected curvilinear trend with marked differences between species. This trend was rectified by plotting on log-log paper, and the data were converted to logarithms for regression analyses. Position of branch, from upper to lower crown, had no consistent effect so it was not considered further. Analysis by seasons showed that number of leaves for any hardwood did not vary significantly by season, but that there was a significant variation of leaf area and weight for many species. As a result of these analyses each species was treated separately.

For estimating number of leaves by branch diameter, regression equations for each hardwood species were computed from the combined data from all samplings. Because shortleaf pine develops new needles well into the growing season, and old ones drop irregularly from their second to fourth seasons, two estimating equations were computed for this species—one for early season and one for mid- and late season.

We utilized the estimating equations and the tally of branch sizes to determine the total number of leaves for each sample tree. To more completely cover the whole range of tree diameters, additional trees were sampled for number of branches by diameter classes.

These estimating equations for leaf number by d.b.h. were computed for each species represented in Stand 1. Crown class had no consistent effect on this relationship because normally the dominant trees have large crowns and d.b.h. and overtopped trees have small crowns and d.b.h. Accordingly, crown class was not considered further.

All regressions were tested and found to be highly significant at a 0.1 percent level of probability. The general form of the equation is: $\text{Log } N = a + b(\text{Log } X)$, where N = number of leaves, a = constant, b = slope coefficient, and X = branch diameter in inches, or tree diameter in inches.

White oak, black oak, and scarlet oak regressions showed no incon-

[4]The adequacy of an 8-leaf sample for area and weight measurements was established from analysis of preliminary data. In the case of twigs having eight leaves or fewer, all were collected and used as the sample.

[5]Clarence H. Burrage, forester, T.V.A., Division of Forestry Relations.

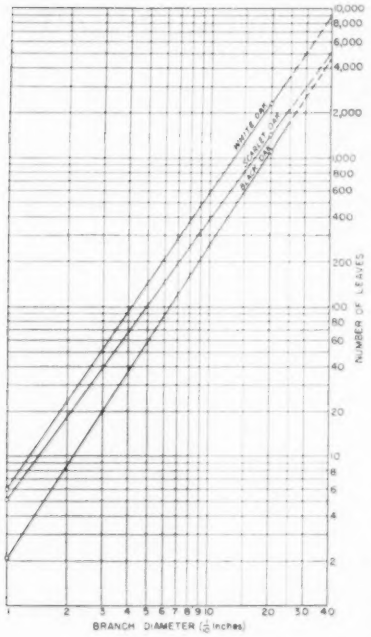
TABLE 2.—AVERAGE LEAF AREA AND LEAF WEIGHT OF PRINCIPAL SPECIES SAMPLED AT 6 DIFFERENT TIMES[1]

	Area							Weight							Branches sampled
	1948 Growing season			1949 Growing season			Std.	1948 Growing season			1949 Growing season			Std.	
	Early	Mid	Late	Early	Mid	Late	dev.	Early	Mid	Late	Early	Mid	Late	dev.	
	Sq. cm.	*Sq. cm.*	*Sq. cm.*	*Sq. cm.*	*Sq. cm.*	*Sq. cm.*	*Sq. cm.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*No.*
White oak	32	36	38	57	50	28	17	0.20	0.24	0.23	0.38	0.35	0.19	0.12	85
Black oak	**79**	**95**	93	69	94	61	30	.64	.74	.84	.51	.83	**.53**	**.28**	**93**
Scarlet oak	41	56	63	55	52	48	13	.33	.50	.45	.49	.44	.46	.13	78
Chestnut oak	70	51	58	44	63	53	23	.32	.35	.34	.24	.45	.43	.14	71
Southern red oak	45	46	38	55	41	46	13	.35	.52	.33	.49	.41	.42	.14	57
Post oak	62	40	60		49		15	.46	.38	.74		.51		.17	27
Mockernut hickory	232		178	115	120	75	77	1.51		1.94	.80	1.69	.82	.65	32
Red hickory	108		104	136	153	96	30	.47		.78	.88	1.35	.62	.26	29
Sourwood	32	26		31	35	29	6	.11	.13		.13	.15	.14	.04	49
Blackgum	22	22		26	23	25	7	.12	.12		.15	.15	.11	.05	55
Dogwood	30	32		23	26	37	11	.13	.14		.11	.11	.15	.05	39
Shortleaf pine	3.3	2.8	3.9	2.8	3.1	3.0	0.6	.029	.019	.037	.025	.021	.024	.006	61

[1]Averages differ significantly for each species except leaf area of chestnut oak, southern red oak, and shortleaf pine, and both area and weight of dogwood, sourwood, and blackgum. The individual sampling unit which was the basis for computing standard deviation averaged 8 leaves on each branch. Hickoriesdid not differ significantly by number but did by area and weight—number of leaflets for mockernut 7, for red hickory 5. Pine leaves are fascicles averaging 2 needles each.

FIG. 1.—Logarithmic relationship of number of leaves and branch diameter. Estimating equations are:

White oak $\quad \text{Log } N = 0.78752 + 1.97244 \text{ (Log } X)$
Black oak $\quad \text{Log } N = 0.33281 + 2.08168 \text{ (Log } X)$
Scarlet oak $\quad \text{Log } N = 0.72889 + 1.85701 \text{ (Log } X)$



sistency in the five stands sampled. On the assumption that they can be applied to other oak stands, the estimating equations for these three species are shown graphically in Figures 1 and 2. The fact that the slope coefficients approach 2.0 corresponds with Cummings' (*5*) findings of a highly significant relationship between the number of leaves and the square of the branch diameters on a silver maple tree. Logarithmic equations for number of leaves by tree diameter (Fig. 2) are a better description than the relationship to the square of tree diameter or basal area by which the coefficients would be 2.0. Leaf numbers for the principal species are given for two diameters of branches and trees in Table 3. These, plotted on log-log graph paper, will give regression lines from which number of leaves for other diameters within the sampling range can be read (Figs. 1 and 2).

Application

A test of the technique of estimating foliage on an area of forest was undertaken in Stand 1 (Fig. 3). For a transpiration study on this acre, it was necessary to estimate the total area of leaf surface bearing stomata (under side only on hardwood leaves). To do this, we used a stand table, estimating equations for number of leaves by d.b.h., and data on area and weight per leaf. First, number of leaves per tree was estimated for each species and d.b.h. class represented. Then, area and weight of leaves per tree were computed by species and d.b.h. Finally, number, area, and weight of leaves per acre were expanded for each species and d.b.h. The total number of leaves, as determined by repression equations, averaged nine million per acre with minor variation. The leaf areas and weights given in Table 2 were used to convert the number of leaves to these measures of quantity which show significant seasonal variation. Foliage area on the acre for the six seasons sampled ranged from a maximum of 5.2 acres in the mid-season of 1949 to a minimum of 4.3 acres in the late season of 1949. Minimum weight of foliage was 1.3 tons in the early season of 1948; the maximum was 1.7 tons in the mid season of 1949.

The estimates for the sample acre are based on actual leaf measurements as found at the time of sampling. The percent of total area destroyed by insects and diseases varied considerably for species, season, and year. In the early season, for example, an average of 3.7 percent of the foliage area on the principal species of oak was dead or eaten by insects. By midsummer this percentage had increased to 5.4 and by late season to 6.7 percent.

Estimates were built up for the sample acre with use of a stand

TABLE 3.—NUMBER OF LEAVES PER BRANCH AND PER TREE AT 2 DIAMETERS EACH FOR PRINCIPAL SPECIES

Species	Leaves by branch diameter		Branches, basis	Leaves by tree d.b.h.		Sampling	
	0.1″	2.0″		2″	8″	Trees, basis	D.b.h. range
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*In.*
White oak	6.13	2,250	93	2,880	35,900	31	1.3-17.1
Black oak	2.15	1,090	104	996	13,100	31	1.5-14.9
Scarlet oak	5.36	1,390	89	2,750	24,700	27	1.1-16.5
Chestnut oak	4.25	1,740	69	1,450	25,700	17	1.0-10.6
Southern red oak	5.33	2,270	57	2,530	26,800	15	2.0-14.7
Post oak	4.95	650	24	1,140	9,800	10	1.8-14.5
Hickory	1.16	318	58	588	4,860	16	1.4-12.2
Sourwood	9.48	1,990	49	2,720	18,600	15	1.8- 9.6
Blackgum	5.69	4,220	55	2,600	32,900	14	.8- 6.1
Dogwood	5.49	3,200	39	3,030	51,900	14	1.3- 5.5
Shortleaf pine—							
Early season	18.6	17,000	29	10,200	211,000	17	1.6-11.8
Mid & late season	57.9	36,700	35	25,700	470,000	17	1.6-11.8

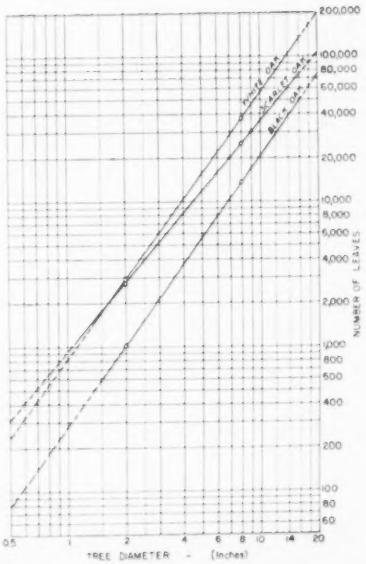


FIG. 2.—Logarithmic relationship of number of leaves and tree d.b.h. Estimating equations are:

White oak $\quad \text{Log } N = 2.91176 + 1.82547 \text{ (Log } X)$
Black oak $\quad \text{Log } N = 2.43913 + 1.86381 \text{ (Log } X)$
Scarlet oak $\quad \text{Log } N = 2.96212 + 1.58894 \text{ (Log } X)$

table giving the number of trees of each species by 1-inch d.b.h. class. Average estimates on the sample acre for all six seasons are given in Table 4 in which the stand has been condensed to three d.b.h. size classes to economize in space. This exemplifies how the method can be used to obtain quantity of foliage on other unit areas of forest for which stand tables are available. Total foliage on trees greater than 0.5 inch d.b.h. (when converted from metric units to familiar equivalents) had an area of 4.8 acres, and weight (oven-dry) of 1.48 tons per acre. Approximately 60 percent of the total basal area (60 square feet) in this stand is made up of upland oaks, and they carry the same percentage of the total foliage. Following a heavy cut 15 years ago, sourwood became the principal component of the understory. It accounts for over 20 percent of the total basal area and over 17 percent of the total leaf area.

TABLE 4.—CONDENSED STAND TABLE AND THE NUMBER, AREA, AND WEIGHT OF LEAVES ON ONE ACRE IN STAND NO. 1, CLEAR CREEK FOREST EXPERIMENTAL ACRE[1]

Species	Trees by d.b.h. class					Leaves		
	0.5—4.9	5.0—10.9	11.0 plus	All	Basal area	Number	Area	Weight, oven-dry
	No.	*No.*	*No.*	*No.*	*Sq. ft.*	*1,000*	*Sq.m.*	*Kg.*
White oak	85	13	2	100	7.71	840	3,240	212
Black oak	79	3	5	87	7.60	284	2,414	195
Scarlet oak	14	6	8	28	13.54	787	3,833	327
Chestnut oak	17	3		20	1.78	131	721	47
Southern red oak	9	1	2	12	3.20	214	975	94
Post oak	4	1	1	6	1.54	38	209	19
Blackjack oak			1	1	72	26	114	13
Mockernut hickory	78	1		79	1.52	34	541	48
Red hickory[2]	65			65	.72	21	243	17
Red maple	30	1		31	.60	103	258	16
Yellowpoplar	9			9	.34	48	279	19
Black cherry[3]	9			9	.09	12	14	1
Sourwood	339	26		365	12.26	1,082	3,317	140
Blackgum	187	1		188	2.35	277	650	36
Dogwood	98	2		100	2.07	294	859	37
Sassafras	27			27	.20	13	39	2
Chestnut	7			7	.04	7	49	2
Flameleaf sumac	5			5	.03	1	6	1
Shortleaf pine	5	7		12	3.26	4,533	1,398	113
Virginia pine	2	1		3	.53	322	81	6
Trees—No.	1,069	66	19	1,154				
Basal area—sq. ft.	19.01	18.25	22.84		60.10			
Leaves—1,000	2,089	5,804	1,174			9,067		
Area—sq.m.	7,180	5,889	6,171				19,240	
Weight—kg.	427	399	519					1,345

[1]Area and weight values are based on averages for the 6 seasons: early, mid, and late in both 1948 and 1949. Area is for one side of leaves, except on pine which is entire surface of needles.

[2]Includes 18 pignut hickory.

[3]Includes one persimmon and three serviceberry with similar leaf measurements.

Discussion

The technique described here should prove useful for estimating the quantity of foliage on hardwood trees. The relation of number of leaves to diameter for white, black, and scarlet oaks may be immediately applicable in other areas. For the other species the relationships given in Table 3 should be verified before use. First, tally branches by size on trees of different d.b.h. Then determine the number of leaves by branch size, accumulate for each tree, and compare with the direct estimate from the d.b.h. Branch sampling and leaf counting should be done where necessary. Except for comparative estimates on white, black, and scarlet oaks, the leaf areas or weights given should always be checked against several local samples of eight leaves.

Sampling of five areas, covering a wide range of geographic location and site quality, showed no significant difference in number of leaves by d.b.h. Others have found no noticeable influence of sites I to IV on quantity of foliage (*8*). This would indicate that estimating equations for any given species may be applied widely throughout the area typical of the forest type studied.

It is of interest to compare the quantity of foliage (4.8 acres in area averaging 1.48 tons, dry weight) for the sample acre of mixed oak in eastern Tennessee with other stands. Potts (*9*) estimated that oak stands in New England had 3 to 6 acres of leaf surface and a foliage weight (oven-dry) of 1.17 tons per acre. In Wayne County, western Tennessee, estimating equations applied to detailed stand tables gave 7.1 acres of leaf surface for a young shortleaf pine stand with an admixture of hardwoods.

Information on the quantity of foliage produced by a forest cover is useful to those who are concerned with the influence of the forest on such factors as rainfall interception, evaporation, transpiration, and deposition of litter, and the changes that result from various management practices. In addition to the purely physical effect of live foliage on interception and of dead foliage (litter) on the control of surface runoff, there are other points to consider. Our knowledge of how organic matter affects the hydrologic properties of the soil has increased greatly in recent years. Estimation of the quantities of foliage produced by different forest types and conditions could add to the knowledge of the types of management that are necessary to maintain or improve the organic content of soils. Quality—chemical composition—of the foliage also varies greatly with species. Future studies may show the importance of maintaining a litter that contains a relatively high content of the necessary mineral elements. For instance, there is some indication at present that the hardwood understory in a predominantly pine stand may be necessary to maintain optimum soil conditions. Such studies will require information on the quantity and distribution of foliage by spe-

cies. Once regression equations are established for the species found on the area, it is relatively simple to determine satisfactory estimates of total foliage.

Summary

An effective technique was developed for estimating the quantity of foliage in mixed oak stands in the Tennessee Valley.

Leaf measurements collected at three stages of growth in two successive years showed that on the sample acre both leaf area and leaf weight varied significantly, but that number of leaves was constant. Estimating equations for number of leaves by diameter of both tree and branch were developed for several hardwoods and shortleaf pine. Those for white, black, and scarlet oaks have been validated in oak stands in five localities. The stand table for a forest area and a similar tally of branch sizes for the tree provide a framework for these estimating equations. They can be used, together with average leaf data, to give foliage area or weight for a forest stand as well as a single tree.

In a sample acre of mixed oak forest, with a basal area of 60 square feet, seasonal variation in foliage area (transpiring surface) ranged from 4.3 to 5.2 acres; foliage weight (oven-dry) ranged from 1.3 to 1.7 tons per acre.

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Favorable Seedbed Conditions for Loblolly Pine Disappear 3 Years After Logging

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BECAUSE OF THE build-up of hardwood competition after seed-tree or strip cutting in loblolly pine, prompt establishment of reproduction has been recognized as an obvious requirement for success. For that reason recent studies have been made of the indicators of seed producing ability of individual trees (*4, 7*), cone crop forecasting methods (*6*), release effects and other means of supplementing seed supplies (*8*), seedbed conditions (*2, 5*), activities of birds, rodents, and insects (*3*), and the control of hardwoods (*1*). It is clear that hardwood sprouts alone pose a serious threat to the success of seed-tree or strip cuttings, but it has also been found that the effect of time since logging or site preparation on seedbed conditions must be recognized as an additional reason for desiring prompt regeneration. In fact, observations in the Bigwoods Experimental Forest[1] show that delayed seeding may be partially responsible for some of the poor stocking heretofore blamed on the hardwoods. The study of this aspect of the regeneration problem was made on thirteen 40-acre logging units which were cut during the calendar years 1946 through 1950.

Method of Seedbed Preparation

The thirteen areas are a part of a long-time management study, one phase of which tests fire versus no fire, and intensive cultural practices versus none. In efforts to regenerate these areas two types of seed source were left, either eight large pine seed trees per acre or alternating 1-chain strips of pine at 4-chain intervals. Logging was conducted year round. At the regeneration period the fire treatment was primarily for seedbed preparation. Burning followed logging and preceded seedfall. Very hot fires generally occurred in the slash areas. As part of the intensive cultural practices, a heavy bush and bog disk was used before logging to cut surface roots and expose mineral soil. Both fire and the disk increased the percentage of the area classed as good seedbed for loblolly pine. One-fourth of the areas received no seedbed preparation other than logging.

Estimates of Seed Production

Estimates of sound seed were obtained each year from a series of representative stands by trapping. Nine randomly spaced 1/4-milacre traps per stand were found adequate to estimate seedfall within reasonable limits during an average seed year.

During the study period both bumper and very poor seed years occurred. In general terms 1946 was very good, 1947 was a bumper crop, 1948 and 1949 were very poor seed years, and 1950 was about average. Both seed-tree and strip cuttings consistently produced large seed crops three growing seasons after release. Table 1 shows by years the maximum and minimum estimates of sound seed from trapping records. Extremes of 4.4 thousand and 311.5 thousand seed per acre were trapped from the same seed source in different years. With such large variations in seeding from a uniformly selected seed source, it is obvious that any attempt to explain or plan for regeneration must begin with a consideration of available seed.

TABLE 1.—MAXIMUM AND MINIMUM YEARLY SEED YIELDS FROM SEED-TREE STANDS (SCATTERED SEED TREES OR CHAIN-WIDE SEED-SOURCE STRIPS)

Year	Number of sound seeds per acre	
	Minimum	Maximum
	Thousands	*Thousands*
1946-47	78.8	92.4
1947-48	98.0	98.5
1948-49	4.4	82.9[2]
1949-50	15.5	145.8[2]
1950-51	30.7	311.5[2]

[2]Seed production was stimulated following the third growing season after release.

Reproduction Study Plots

The two areas harvested in 1946 were sampled for regeneration by randomly selected milacres on which the seedbed was classified. Plot centers on these two areas were not marked on the ground until 1949. However, beginning in 1947 a series of 100 mechanically spaced plot centers were permanently located in each of the eleven logging units cut thereafter.

Beginning with the earliest seedling examinations, seedbed conditions were separated into four broad classifications. If a fire occurred on the majority of the milacre it was classed as a burned plot. On an undisturbed plot no soil disturbance was permitted. On a slash plot the majority of the plot was covered with pine or hardwood slash. A plot was classed as disturbed if any portion of the plot was disturbed to mineral soil by logging or disking. Thus the undisturbed plots were the most uniform, and the disturbed condition was the most varied. Each plot was examined and classified after logging or fire.

Counts of living pine seedlings were made on each milacre following the initial treatment and at the end of each subsequent growing season. These counts give total seedling survival at each date. They have shown the rate of increase in the number of seedlings each year as related to the amount of seed available and the original seedbed condition.

The Utilization of Seed

The average number of seedlings found at the end of each growing season, when related to amount of seedfall, show the best utilization of seed on seedbeds that permit the seed to come in contact with min-

[1]Maintained by the Southeastern Forest Experiment Station, Forest Service, U. S. Dept. Agric., in cooperation with Camp Manufacturing Company, Inc., Franklin, Va.

TABLE 2.—NUMBER OF SOUND SEED TO PRODUCE AN ADDITIONAL SEEDLING AT THE END OF THE GROWING SEASON, BY SEEDBED TREATMENTS OF ENTIRE LOGGING UNITS[1]

Cultural practice	1st year	2nd year	3rd year	4th year	4th & 5th year
	Number	*Number*	*Number*	*Number*	*Number*
Disk and log	7	37	187	—	—
Log and burn	15	69	211	—	200
Log only	22	63	81	143	227
Average all areas	14	50	162	143	212

[1]The data in each vertical column are averages which sample one to fourteen different years.

eral soil. Both the disturbed and burned plots produced more seedlings than the undisturbed and slash plots under all levels of seeding.

Under actual management it is the aggregate of all seedbed conditions on the area that is important. When all the logging units are grouped by the primary seedbed improvement practices applied to whole units, we find that during the first year disking is superior to burning and burning is superior to no treatment on logged areas (Table 2).

During the second year after site preparation or logging three to five times as many seed were required to add a seedling, and in the third year, seed requirements were still larger. For all areas an average of 14 seed were needed to add a seedling the first year, 50 the second, and 162 the third. During the fourth and fifth years seed requirement continued large on the three oldest areas. The increase in seed requirements with age of seedbed may be caused by a rapid build up of low competition which undoubtedly increases seedling mortality and begins to build back a forest litter. Seed losses to birds, insects, and particularly rodents may increase.

These data show that by the third year after logging, at which time the release of loblolly pine seed trees is reflected in an increase in seed production, seedbed conditions have already deteriorated.

Competition is at a minimum upon completion of logging and cultural practices. Unfortunately, hardwood competition generally develops rapidly with the passing of time. For any amount of seed, more seedlings will become established the first year, fewer the second year, and beginning with the third year the utilization of seed is poor. These relationships emphasize the importance of planning silvicultural operations so that ample seed is available when the seedbed conditions are most favorable.

Foresters agree that a measure of seedling distribution and not the average number of seedlings is the preferred method for judging the success or failure to regenerate a stand. This point is aptly illustrated by the data from this study. On well stocked areas (90 percent milacre stocking or better) the average number of seedlings per acre has increased after the first year, but there was a reduction in the number of stocked milacres. The best seedbed is usually stocked the first year and much of the increase in number of seedling occurs on stocked plots.

The importance of utilizing the potential of 1-year seedbed is well illustrated by the records of two areas, one receiving very little seed and the other receiving adequate seed the first year. The first area was cut in 1948 and the logging slash was burned. Following logging and burning but before seedfall, 21 percent of the milacres contained at least one holdover seedling. Seedfall was estimated as 4.4 thousand sound seed per acre, and at the end of the first growing season, 49 percent of the milacre plots contained a seedling. During 1949, 18.8 thousand sound seed were cast, and stocking rose to 59 percent. In 1950 the seed trees showered down 311.7 thousand sound seed, and stocking rose to 82 percent.

In contrast, the other stand was cut and burned in 1950. Only 4 percent of the milacres were stocked just after logging and fire. The seedfall was estimated at 30.6 thousand sound seed per acre, and at the end of the 1951 growing season 95 percent of the milacres were stocked.

The difficulty encountered in increasing poor first-year stocking that results from poor first-year seeding is borne out by the six stands regenerated by the 1948 and 1949 seed years. At the end of the 1951 growing season only one of the six stands was satisfactorily stocked with seedlings even though site preparation measures were applied on several of the areas. As these poorly stocked stands enter their third or fourth growing season, it appears that improved stocking will not result from additional seeding.

Coordinating Seed Production With Seedbed Conditions

Good management will favor cutting for regeneration in good seed years and avoid these harvests when seed crops are poor. The only way to assure abundant seed each year is to adopt a planned regeneration schedule. Seed trees are released three growing seasons before the final harvest (*8*), and then optimum seeding and seedbed conditions occur together. Fire and other mechanical treatments may or may not be used to increase the initial stocking. Where the initial stand to be cut is poorly stocked with pine, these intensive measures may be required because hardwood competition is likely to be more severe and the release effect on seed trees may not be useful. Well-stocked pine stands which are given a preparatory cut to release seed trees should need much less seedbed preparation. Planned regeneration measures such as these are sure to become a more important part of loblolly pine management if the trend toward higher land and timber values continues.

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The Vegetative Propagation of Ginkgo[1]

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ALTHOUGH Ginkgo, botanically *Ginkgo biloba* L., is used principally as a street tree and for other ornamental planting, the wood is suitable for commercial purposes (2) and there is much to commend the species as a possible forest tree.

This tree makes good growth, often increasing in diameter at the rate of ½ inch per year in the eastern and midwestern United States; the form is desirable for the production of posts; and the wood is durable, there being usually no heartwood decay or unsound wood in the living tree (1). Ginkgo does not appear to be seriously attacked by fungi or insects (3) and is highly resistant not only to parasites but also to adverse site conditions and to smoke in the air (1).

Cuttings of Ginkgo made by Teuscher (5) from the basal parts of young shoots in late June rooted well after treatment with a hormone powder. Whether such cuttings would root without treatment was not determined. The soft tips of young shoots similarly treated died unrooted. Results summarized below suggest that these softer cuttings may have been injured by this treatment.

Stem cuttings of Ginkgo, apical and basal parts of the current year's growth, were taken in Amherst, Massachusetts, on June 18 when the new shoots were about eight inches long. Apical and basal pieces were each about four inches in length. Cuttings, with or without treatment with a root-inducing substance, were immediately set in sand in a bench in the greenhouse, there being at least forty-five cuttings in each treatment.

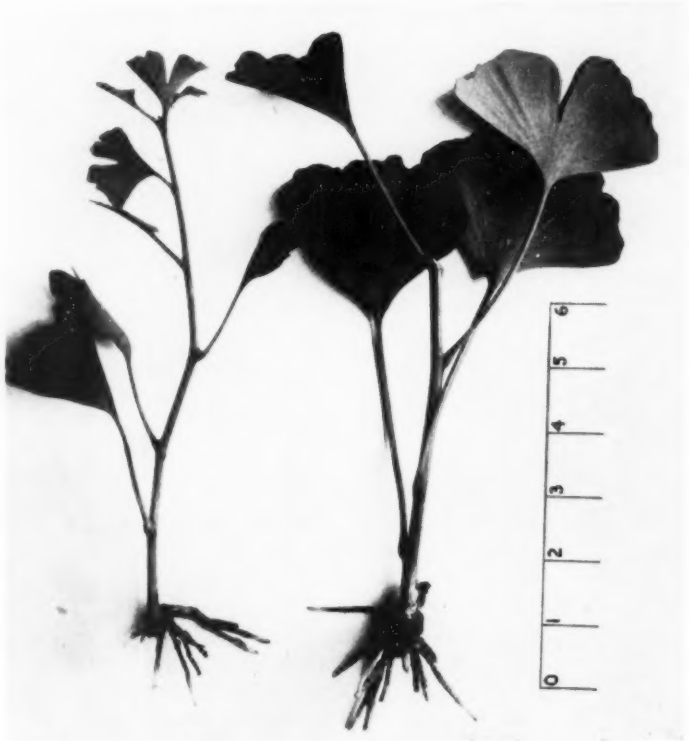

FIG. 1.—Rooted stem cuttings of Ginkgo.

All cuttings were from male or staminate trees. The male Ginkgo is to be preferred to the female or ovulate tree, for the outer coat of the fruits, borne on the female trees, is highly malodorous. Since the Ginkgo does not flower until it is twenty to thirty years of age (5) and since the sexes cannot be distinguished earlier, the only way to obtain young trees known to be male is by vegetative propagation.

The percentages of stem cuttings of Ginkgo that rooted when taken in mid-June are recorded in Table 1. These are the percentages of cuttings that had rooted when all unrooted cuttings had died. Rooted stem cuttings of Ginkgo, apical and basal parts of the new shoot, are shown in Figure 1.

Untreated stem cuttings rooted well, the apical parts rooting in

[1]Massachusetts Agricultural Experiment Station Contribution No. 876.

This work was undertaken at the suggestion of Professor R. P. Holdsworth, head of the Department of Forestry of the University of Massachusetts.

larger percentages than the basal parts.

Rooting of apical stem cuttings was not improved by powder-dip treatment with indolebutyric acid in Hormodin No. 2, and such cuttings rooted in smaller percentages after solution-immersion treatment with indolebutyric acid 50 milligrams per liter of water for 23 hours than without treatment. It appears from this that apical stem cuttings of Ginkgo taken here in mid-June need not be treated with a root-inducing substance.

TABLE 1.—ROOTING OF STEM CUTTINGS OF GINKGO BILOBA TAKEN IN MID-JUNE

Type of cutting	Treatments of cuttings	Percentages of cuttings which rooted	
Apical	Untreated	100	percent in 61 days
Basal	Untreated	79.4	percent in 79 days
Apical	Indolebutyric acid 50 mg./l., 23 hr.	52.2	percent in 48 days
Basal	Indolebutyric acid 50 mg./l., 23 hr.	92.2	percent in 33 days
Basal	Indolebutyric acid 100 mg./l., 23 hr.	79.1	percent in 48 days
Apical	Hormodin No. 2	100	percent in 61 days
Basal	Hormodin No. 2	92	percent in 61 days
Basal	Hormodin No. 3	100	percent in 48 days

FIG. 2.—Rooted short shoots of Ginkgo.

Rooting of basal stem cuttings was improved and hastened by treatment with indolebutyric acid 50 milligrams per liter for 23 hours, and their rooting was less hastened and not otherwise improved by indolebutyric acid 100 milligrams per liter for 23 hours. Injury may have resulted from the greater concentration, indolebutyric acid 100 milligrams per liter, the leaves on cuttings so treated becoming yellow within one month after treatment.

Rooting of basal stem cuttings was more improved and hastened by Hormodin No. 3, which contains 8 milligrams indolebutyric acid per gram tale, than by Hormodin No. 2, which contains 3 milligrams indolebutyric acid per gram tale. (Table 1)

Brachyblasts, the short shoots or dwarf branches that bear the leaves of Ginkgo on older growth, were also used for cuttings in mid-June. These rooted 31.6 percent without treatment, 78.9 percent after treatment with Hormodin No. 1, and 100 percent in 61 days after treatment with Hormodin No. 2. Such short shoots after rooting are shown in Figure 2. It is doubtful that such cuttings will be useful in practice, but the fact that short shoots root at all is of interest.

Stem cuttings of Ginkgo, apical and basal parts of the current year's growth, were again made in late July, thirty-seven days after such cuttings were first taken. Both apical and basal types, with or without treatment with a root-inducing substance, rooted poorly as compared with cuttings taken earlier. Untreated cuttings rooted 4.9 percent and cuttings treated with indolebutyric acid 50 milligrams per liter for 23 hours or with Hormodin No. 2 rooted 19.3 percent.

Summary

Stem cuttings of *Ginkgo biloba* made from new growth, growth of the current year, rooted well if taken in mid-June.

Cuttings made from the apical half of the new growth rooted well without treatment and no better after treatment with a root-inducing substance.

Cuttings made from the basal half of the new growth rooted in larger percentages or more rapidly after treatment with indolebutyric acid 50 milligrams per liter for 23 hours or after treatment with Hormodin No. 3 than cuttings without treatment.

Similar cuttings, whether or not they were treated with a root-inducing substance, rooted much less well if taken in late July rather than in mid-June.

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Leaf Litter as a Killer

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In addition to their passive role in forest soil development, dead leaves, while still firm, often play in forestry the aggressive and important role of a villain. More often than is noted, abundant leaf litter exercises a serious adverse influence on the regeneration of desirable forest species in mixedwoods. Research is needed to ascertain the degree of harm being done by dead leaves, in relation to the major variables, and to find practical means for minimizing such damage.

THE APPARENT PASSIVITY of dead leaves is misleading, as they often play an active and important role in forest regeneration. Sometimes they help the forester in his efforts to get reproduction of desirable forest trees; where abundant, they frequently frustrate his endeavors. Before it settles down, to decay and to be gradually absorbed into the soil, much of the leaf litter is shifted repeatedly by the wind, and thereby its influence is extended. In certain cases dead leaves have only a mild effect, but in others they really play havoc with the reproduction of valuable tree species. They affect reproduction during its most vulnerable, early period—greatly, but so inconspicuously, that they usually escape the blame.

Leaf Litter as a Hindrance to Spruce Restocking

In elaborating on the subject in this paper, with special reference to leaf litter as an adverse factor in spruce restocking in northern mixedwoods, the writer will depend only in part on his own field observations and his reasoning; he will lean essentially on statements he collected recently from fifty-five northern foresters. The literature on this subject seems as yet to be meagre.

To use a reference at hand, about 200,000 leaves were counted on a large birch[1]. Suppose that in a mature stand in eastern Canada, consisting of 50 percent birch and poplar or maple and 50 percent white and black spruce and balsam fir, 75 large hardwood trees would annually carry and drop to the ground some 15 million leaves per acre. That would be approximately enough to cover the ground fully with a double leaf layer, even disregarding the older, still firm, leaves in the litter and the new leaf crop from the undergrowth and the lesser plants. Some leaves will stay where they fall, but most of them will be shifted by the wind, probably more than once. The pattern of leaf distribution on the forest floor at a given time will depend on many factors, some of which are mentioned in this paper, but in some spots the litter is likely to be much thicker than in others. Depending on the season and the weather (wind, rain, etc.), certain areas, such as small scarified spots with mineral soil exposed, may be loosely filled with dry leaves, plastered with wet leaves, or bare.

In operating such mixed stands, northern foresters often fail to get good regeneration of spruce. It has often been observed that duff only two or three inches thick prevents the establishment of spruce seedlings, whereas they start on exposed mineral soil much more readily. Hence there are increasingly frequent recommendations for scarification of the soil as a means of encouraging reproduction. Yet a number of foresters have also observed that, under certain conditions, new spruce seedlings are commonly abundant in the summer, but their number declines rapidly and most, if not all, of them have disappeared before the winter. With this in mind, and with special regard to the role of leaf litter, one may now consider what is apt to happen with respect to natural spruce restocking in our mixed forests, following a seed fall.

In eastern Canada white spruce sheds its seed in the autumn, starting shortly before or at about the same time as the leaf fall, and discharges most of its seed by the middle of November. Thus, the bulk of the seed that falls upon leaf litter areas will soon be under the new leaf layer and in its midst. The rustling of the leaves will help such placement of the seed, and the minor portion that is on the surface may be reduced further, or even eliminated, by feeding mice and birds. Although the seed fall of black spruce is apparently not subject to great seasonality, it is probable that even with this species most of the seed will be found between the leaves and below the new leaf fall rather than on the surface, when the leaves settle down.

If a spruce seed germinates on a firm leaf, can the tiny rootlet pierce the leaf, and can the feeble plumule penetrate a covering leaf or emerge from under it otherwise? Avoidance might be a possibility, but hardly penetration; and the seedling probably will be doomed if it is trapped in the midst of a new leaf layer or, as occurs still more frequently, under it. The baby plant may "crawl around" for a while, but it will die. It seems probable that where leaf litter is rather heavy, much or even most of the spruce seed supply will find its grave in the leaves.

What will happen when young spruce seedlings that have started under favorable conditions — as where mineral soil is exposed—get covered with dead leaves? If the effects of that cover are pronounced and lasting, probably all of them will be killed. Such "murder" of small seedlings by dead leaves is probably common in mixedwoods and may be, in certain cases, the main cause of the failure of spruce restocking. This damage is, however, almost sure to escape all but the closest scrutiny. Very young spruce seedlings are quite incon-

[1]Myhrwold, A. K. Textbook of silviculture. Grondahl & Sons, Oslo. p. 465, 1928.

specious, and their "corpses" even more so; and the leaves that did the killing may still be there or they may have been blown away.

As many foresters have stated, the presence of only a few dead leaves on the seedbed may have a good effect on the germination and establishment of spruce seedlings, by exerting a favorable microclimatic influence. Whether the influence is good or bad will, however, depend upon the circumstances of each individual case.

Between the beneficial influence of the leaves and the outright killing of young spruce seedlings by them, there must be a great many cases of injury by dead leaves through a degree of smothering, crushing, shading, etc. There can be little doubt that a large percentage of the seedlings so affected succumbs later on, essentially as a result of the initial loss of vigor and the setback in growth caused by the leaves, even though this mortality is not commonly attributed to this cause.

Since the cotyledons and young seedlings of spruce are smaller and more delicate than those of balsam fir, leaf litter probably contributes to the usually greater success of the latter species in restocking of the areas in which both balsam and spruce are associated with hardwoods.

It is also probable that leaf litter plays a rather important, though not usually recognized, role in the mechanism of gradual supersession of our northern softwoods by hardwoods in those mixed forests where the balance has been upset by heavier cutting of coniferous species.

Evidence Obtained Through Correspondence

To supplement his limited information regarding leaf litter as a killer, and to check the validity of his concept, the writer recently asked 59 experienced Canadian and American foresters[2] to give their views and such pertinent facts as they might have. Four did not respond and four replied rather noncommittally; but 51 foresters indicated their belief, or conviction in some of the cases, that leaf litter is often an important hindrance to the regeneration of certain desirable forest tree species. Sixteen of these men subscribed to that idea, while indicating that previously they had hardly concerned themselves with the matter; 20 depended on only casual observations; and 15 foresters based their statements on more or less definite research findings, which have apparently not been published. The great majority felt that the subject calls for more research and attention than it is now given.

The European forestry literature, while dealing to some extent with undecomposed leaves as an unfavorable seedbed, appears to lack substantial data on leaf litter as an active killer of tree seedlings.

The following paragraphs contain condensations and extracts from letters to the writer by American and Canadian foresters who have studied the influence of leaf litter upon restocking:

E. Bonner, Spruce Falls Power and Paper Company, Kapuskasing, Ont.—In October, 1939, when most leaf fall was down, under an overstory of poplar and birch, seed spots were made by removing the leaves and litter, then scattering black spruce seed and pressing it in. A year later only 18 percent of the spots were stocked, and the seed spots were "badly leaf covered, often with a solid mat of leaves"; all the seedlings were small and frail; and they all were smothered by that year's leaf fall.

D. H. Burton, Ontario Department of Lands and Forests, Dorset.—Through his research in natural restocking of yellow birch, Burton found that the birch seedlings, starting under the leaves generally grow to 0.5-1 inch and are then smothered; ". . . there is no doubt that a complete cover of one leaf only is sufficent to kill a birch cotyledon"; the roots of those starting on top of leaves nearly always fail to penetrate the litter, and die. Of the birch seedlings which survived the first growing season, in the cracks of the litter and on exposed mineral soil, and which were individually tagged, only 30 percent were alive the next September. It was concluded that while undisturbed leaf litter restricts germination of yellow birch seed, the seedlings that start under a closed crown canopy grow so slowly and are so weak that they get smothered by the second subsequent fall of leaves. Hard maple leaves are a greater hindrance to restocking of yellow birth than are the leaves of birch, beech, and elm, which tend to curl.

V. H. Phelps, Forestry Branch, Department of Resources and Development, Winnipeg, Man.—It was found in Manitoba that, with an adequate seed supply, white spruce seedlings start on suitable seedbeds in great numbers but about three-quarters of them die within a year. An examination of two-year old seedlings on about 2,000 small plots (half of them on scarified ground) indicated that about one-half of the seedlings' mortality could be attributed to crushing and smothering by dead leaves. In Saskatchewan, Phelps noted many one-year white spruce seedlings struggling to emerge laterally from between poplar leaves; but he believes that many others perished in the leaves.

E. I. Roe, Lake States Forest Experiment Station, Grand Rapids, Minn.—In a seed spot study, "a total of 370 one-year old balsam seedlings, established on 136 plots, had shrunk to 208 seedlings by the end of the second summer. Eighty-three per cent of the dead seedlings had been smothered under a heavy layer of birch and hazel leaves. During the next two seasons considerable further loss occurred and much of this was also due to smothering. . . ."

Marinus Westveld, Northeastern Forest Experiment Station, Upper Darby, Pa.—Red spruce and balsam were seeded on 362 quadrats, representing nine seedbed condition types. The most unfavourable for both spruce and balsam

[2]The men who were approached were mainly those, who, in the writer's opinion, were more likely to have some definite information on the subject than most foresters.

proved to be the seedbeds covered with undecomposed needles or supporting witch hobble in stands containing considerable hardwoods. Westveld found that in the latter case such few seedlings as managed to start were soon smothered by leaves.

Prof. David M. Smith, Yale Forestry School, New Haven, Conn.—Prof. Smith seeded white pine (winged seed) on oak litter and found that the rustling action of the leaves caused the pine seed to penetrate into the litter "so deeply that the newly-germinated seedlings merely crawled around underneath and rarely elevated their cotyledons to the surface. Therefore, practically no seedlings became established, even though germination was apparently fairly good . . . the smaller spruce and hemlock seedlings would be hampered even more than white pine . . ."

Russell K. LeBarron, California Forest and Range Experiment Station, Berkeley.—". . . hardwood leaves seriously impede both the establishment and survival of spruce seedlings . . . A single aspen, birch, or maple leaf is sufficient to smother a new spruce seedling, or to prevent its root from penetrating the soil."

I. C. M. Place, Forestry Branch, Department of Resources and Development, Fredericton, N. B.—". . . if hardwood leaves are present in quantity, they will hinder or prevent germination and establishment of advance growth of spruce and fir . . ."

Paul O. Rudolf, Lake States Forest Experiment Station, St. Paul, Minn.—In a regeneration study in lower Michigan, ". . . a good catch of jack pine was obtained on areas where mineral soil was exposed and over which jack pine cone-bearing slash was spread immediately after logging. In a part of the area, furrows had been used to expose the mineral soil. A considerable number of jack pine seedlings started in the furrows, but in the fall they were completely covered with oak leaves which the furrows held. These seedlings were completely smothered out . . . a number of acorns which also germinated in these furrows were also smothered out by leaf litter."

Dr. Henry I. Baldwin, State of New Hampshire Forestry and Recreation Commission, Concord.—He found in 1924-25, in northwestern Maine, that in artificial seeding of spruce in mixedwoods "hardwood leaf litter is unfavourable not only as a seedbed but it actually smothers seedlings that have succeeded in germinating" either on a natural seedbed or on the plots with mineral soil exposed. Close to 1,500 seed spots were made and some of them were caged, for control. Dr. Baldwin says: "As I recall, the first year showed 85 percent of the uncaged plots to contain one or more seedlings before the fall of leaves in the autumn, but the following year only 15 percent of the spots were classed as successful, the seedlings having been smothered by leaves . . . I found native spruces much more sensitive to smothering by leaves than Norway spruce."

A. Bickerstaff, Forestry Branch, Department of Resources and Development, Ottawa, Ont.—"Several workers in the Forest Research Division have noted mortality of small spruce seedlings resulting from the mechanical action of hardwood leaves. The importance of this factor is mentioned in a paper, by J. S. Rowe . . . yet to be published. We have found in our investigations of the tolerant hardwoods and tolerant mixedwood types that hardwood litter appears to be one of the two chief factors limiting the regeneration of hemlock, cedar, yellow birch, and white birch."

Prof. H. D. Long, Forestry School, University of New Brunswick, Fredericton.—". . . has quite often seen (in eastern Canada) numerous spruce seedlings on the forest floor in the spring and summer but by fall practically all have died. This occurs frequently, year after year." Long mentions dry leaf litter first among the factors responsible for poor natural restocking of spruce in mixedwoods. In the late summer of 1946, at Windsor Mills, Que., Long and the writer found, on examination of a scarified sample plot, on which a good crop of small white spruce seedlings was present a short time previously, that all of them had been smothered by leaves.

The writer of this paper once lost his battle against the invasion of hardwood leaves in the case of Manchurian pine transplants which he planted in the spring in a mixedwood in Quebec. The transplants were 2½-3 inches high and healthy previous to the leaf fall, which smothered all of them.

Damage by Leaf Litter as Related to Other Variables

It appears to the writer that regeneration of desirable forest species often suffers from dead leaves in mixedwoods in the following five ways:

1. The seed fails to germinate on top of or in between the leaves.
2. The seedlings fail in starting upon freshly-fallen or older but still firm leaves.
3. The seedlings fail in starting under or between the leaves.
4. Small, delicate seedlings are damaged and weakened by leaf litter through mechanical injuries, shading, smothering, etc., and a large percentage of them succumb even to such relatively mild, adverse influences as the seedlings could withstand were they not so handicapped. As they are shifted by the wind from time to time, the same dead leaves may cause, during their "active period," such damage in several places.
5) Small seedlings are killed by the leaves which pile on top of them—singly or in a mass, temporarily or permanently.

As leaf litter is merely one of the many variable factors which affect forest regeneration, its net effect on restocking may range from beneficial to fatal. However, it appears that dead leaves frequently do considerably more harm than is evident, by acting either as a secondary or as a primary cause of the regeneration failure. For example, several of the foresters who recently sent information to the writer stated that somewhat

excessive shade from crown canopy, by slowing the growth and lowering the vitality of new seedlings, greatly facilitates their smothering by dead leaves; and, conversely, the degree of shade that healthy seedlings are capable of withstanding, frequently proves fatal to the seedlings which have been weakened by leaf litter.

The degree of harm that leaf litter can cause to regeneration of forest trees depends on their species, on the kind, quantity and distribution of the leaves, and on several other factors. At least 20 foresters recently conveyed to the writer their observations on this subject, but this data does not lend itself to a summary. Still, the indications are that leathery leaves, such as those of hard maple or oak, and perhaps of aspen, do more harm than do the thinner leaves, such as of birch or elm, whose venation causes them to curl when dry. "Anything that prevents compactness aids the seedling in its fight for survival against leaf litter," says Place. Indications came to hand from several foresters that, where abundant, the leaf litter of bushes and of some lesser plants also cause considerable mortality of tree seedlings.[3]

The quantity of firm (undecomposed) leaves on the forest floor is dependent principally on the stand's composition, age and density, on site quality, on the climate and the season. According to J. Kittredge, "The annual fall (of forest litter) varies widely in the same stand in different years, to such a degree that the maximum in one year may be as much as three times the minimum in another."[4] Among the important factors controlling the distribution of leaf litter within the stand are vegetation, meteorology, topography, microtopography and exposure. Trees and even small plants affect the distribution of leaf litter, not merely as a local source of the leaves but by their influence on the air currents which control the movements of dead leaves before their final settlement. The nature of the forest floor cover is also of importance. For example, as stated by Bickerstaff, "Where a carpet of leaf litter predominates, patches of moss are not usually covered" (and, "it has been noted that white pine often regenerates successfully in patches of moss"). As Professor David M. Smith says, "There is a strong tendency for hardwood leaves to be blown out of patches which have an overstory but no understory and deposited in patches which do have an understory"; there is also "a tendency for leaves to be swept off the tops of small ridges and hummocks".

It has been noted that in stands where restocking of spruce, fir, pine, and some other species is quite poor, the seedlings present are often essentially confined to places which are free of heavy duff and are not invaded by leaf litter —to old windfall and rotten stumps, as well as to spots where the mineral soil stays exposed.

Leaf Litter in Artificial Regeneration

Where leaf litter is rather plentiful, its adverse effect on artificial seeding and planting may be quite as great, if not greater than it is on natural restocking. In such areas, broadcast seeding or the planting of small seedlings on natural seedbeds is vulnerable to that damage; and many of the failures in planting and, in particular, in seeding, in prepared spots is probably due to the fact that these spots, being small depressions in the forest floor, tend to act as leaf traps. This applies also to mechanically scarified strips and patches of forest soil, in those locations where dead leaves fall or drift. Phelps, Bickerstaff and his associates; also Stoeckeler, Place, and Rudolf, are among the foresters who have noted in their letters that furrows in plow-scarified areas tend to catch and hold dead leaves, eliminating the seedlings there. Phelps states that the ridges between the furrows, and the upper portions of the slopes, being free of leaf litter, represent a favourable location for the establishment of the seedlings. Some recommend to avoid leaving deep furrows which would catch leaf litter. However, Place maintains that "A flat surface of mineral soil has the disadvantage of giving the seedlings no protection from the crushing effect of such leaves as do settle on it", and he favours broad scarification with high ridges. Stoeckeler found that only 25 or 30 percent of the disked area represented a good seedbed, the ridges being too dry and the bottoms leaf-infested.

Control

This paper aims at attracting more attention to the subject of the adverse effect of leaf litter upon restocking. The data on control measures which would mitigate that damage are yet meagre. "Opening of a stand by partial cutting improves the air circulation and reduces the detrimental effect of hardwood leaf litter", says Bickerstaff. To facilitate spruce restocking in mixedwoods, some suggest gradually cutting hardwoods well in advance of spruce and other softwoods, where commercially feasible and where this would result in a substantial reduction of leaf litter. Breaking the leaf litter layer and mixing it with the soil through scarification may be another means to that end. However, in many cases orthodox silvicultural procedures will hardly give satisfaction and the answer to the problem will have to be sought through research.

Conclusions

Where leaf litter is abundant, it is often a serious hindrance to regeneration of certain desirable forest species. This probably applies not only to northern mixedwoods but quite widely.

[3] J. H. Stoeckeler, Lake States Forest Experiment Station, Rhinelander, Wis., said in his recent letter, "In seedings made in furows . . . we observed up to 80 percent mortality in first year conifers merely from accumulation of an inch or two of dead leaves of sweet fern and blueberry . . ."

[4] Kittredge, J. Forest possibilities of aspen lands in the Lake States. Tech. Bull. No. 60, U. of Minn. Expt. Sta. 1929.

The literature on the "active" influence of dead leaves upon restocking is surprisingly meagre and consists essentially of scattered casual statements, based on qualitative rather than on systematic and quantitative observations.

The subject of leaf litter as a factor in regeneration is complex because of the many other variables that affect restocking at any single locality and because pertinent factors may well elude the observer unless the subject is studied in minute detail.

Substantial research may be needed to establish, in relation to other major variables in regeneration, the importance of leaf litter as a killer, and particularly to find practical means of minimizing the damage.

The writer would greatly appreciate it if those foresters—on this continent and elsewhere—who have done research on leaf litter as a hindrance to restocking or on methods of reducing its influence, would be kind enough to advise him of their findings.[5]

[5]At 3420 University Street, Montreal, Canada. A list of literature on the subject of this paper has been prepared by the author and can be obtained from him on request, but nearly all those references are brief.

Coming Events

North American Wildlife Conference

The 19th North American Wildlife Conference will be held in the Palmer House, Chicago, March 8-10.

New England Section

The New England Section will hold its winter meeting at the Hotel Somerset, Boston, March 11-12.

Southern Forestry Conference

Sponsored by Forest Farmers Assoc. April 26-27, Battery Park Hotel, Asheville, N. C.

Intermountain Logging Conference

April 1-3, Spokane, Wash.

Forest Products Research Society

The 1954 meeting of the Forest Products Research Society will be held in Grand Rapids, Mich., May 5, 6, and 7, under the direction of Fred E. Dickenson, national meeting chairman.

Gulf States Section

The Gulf States Section will hold its spring meeting at Lake Charles, La., May 6-7.

Rating the Effectiveness of Forest Fire Protection

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Forest fire statistics provide a chronological record of the results of fire control, but must be analyzed and interpreted if they are to be of more than historical value. The effectiveness of protection effort, for example, cannot be judged by number of fires and areas burned alone, since conditions vary from year to year and from place to place. Unless the conditions prevailing are taken into consideration the picture is obscured and conclusions can be misleading. A recent attempt to appraise the effectiveness of fire control effort on the Chippewa National Forest in Minnesota led to a partial analysis of available records and the results are here presented as an example of one approach to the problem.

BASED on the record for the past sixteen years, 1936 to 1951 inclusive (see Table 1), the Chippewa National Forest in Minnesota has averaged 45.1 fires a year or 3.5 fires per 100,000 acres; has had a mean annual burn of 580 acres or .044 percent of the area protected; and a mean annual fire size of 11.5 acres. The number of fires per year, however, has varied from 16 in 1945 to 92 in 1939; the annual burn from 65 acres in 1945 to 1,979 acres in 1949; and the average fire size from 2.0 acres in 1938 to 39.6 acres in 1949.

For the period in question, the average number of fires per year exceeded the present "goal" or ceiling of 40 established by the Regional Forester by 5.1, while individual years exceeded it in ten cases. The overall trend in number of fires, however, has been down, and since 1943 the moving five-year average has been close to the objective, indicating currently satisfactory fire prevention (Fig. 2). Since the mean annual burn of 580 acres is considerably below the "goal" of 760 acres established for this forest, suppression effort on the Chippewa would also appear to be adequate. The fact remains, however, that in spite of an overall decrease in seasonal severity and risk, the annual burn and the average fire size have been increasing (Figs. 3 and 4) and the "goal" of 760 acres for annual burn has been exceeded five times by individual years and twice by the five-year moving average.

TABLE 1.—BASE DATA—CHIPPEWA N. F.
Area protected—1,305,640 acres.

Year	Fires	Risk[1]	Area burned		Average fire size	Relative[2] severity
	Number		*Acres*	*Percent*	*Acres*	*Percent*
1936	48	3.7	279	0.021	5.8	18.09
1937	49	3.8	305	.023	6.2	15.31
1938	48	3.7	94	.007	2.0	17.41
1939	92	7.0	702	.054	7.6	20.08
1940	68	5.2	804	.062	11.8	17.49
1941	26	2.0	102	.008	3.9	12.46
1942	63	4.8	1,519	.116	24.1	17.31
1943	30	2.3	151	.012	5.0	17.89
1944	54	4.1	859	.066	15.9	15.35
1945	16	1.2	65	.005	4.1	14.73
1946	55	4.2	545	.042	9.9	16.09
1947	29	2.2	409	.031	14.1	14.73
1948	51	3.9	1,307	.100	25.6	20.79
1949	50	3.8	1,979	.152	39.6	18.83
1950	21	1.6	85	.007	4.0	13.35
1951	22	1.7	81	.006	3.7	11.23
Average	45.1	3.5	580.4	.044	11.5	16.32

[1]Number of fires per 100,000 acres protected.
[2]Over-all seasonal rating of burning conditions.

While the number of fires and area burned provide a measure of the results of fire control, they do not tell the whole story, since obviously more fires and a larger burn are to be expected in years when burning conditions are severe. It is essential, therefore, in judging the effectiveness of protection effort, that both the severity of the fire season and current risk be taken into consideration. On the Chippewa, during the period covered, the overall seasonal severity of burning conditions averaged 16.32 percent of the worst possible,[2] but varied from a low of 11.23 percent in 1951 to a high of 20.79 percent in 1948 (Fig. 1). To determine the effect of this factor, both number of fires and area burned were correlated with seasonal relative severity (Figs. 5 and 6) and the average number of fires and the burn currently to be expected at different relative severity levels determined. In the case of the area burned, the risk prevailing was also taken into consideration by joint correlation with the number of fires. The ratio of the actual number of fires and area burned to the indicated, with

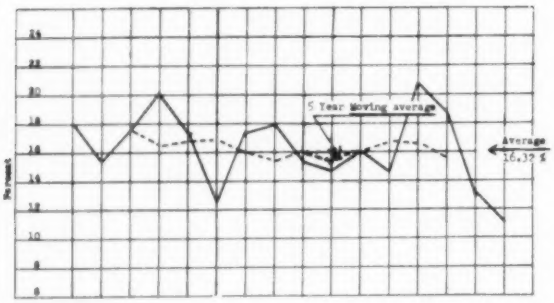
[1]Maintained by Forest Service, U. S. Dept. Agric., in cooperation with the University of Minnesota, University Farm, St. Paul.

[2]Seasonal relative severity expressed as the percent of the worst possible, derived by dividing the weighted total number of days in all burning index classes by the total number of days multiplied by the weight given "extreme" days.

Example

Class of day	Safe	V. low	Low	Mod.	High	V. high	Extreme	Total
Weight	(1)	(2)	(4)	(8)	(16)	(32)	(64)	
No. of days	5	2	3	4	5	3	2	24
No. × Wt.	5	4	12	32	80	96	128	357

If all the days had been "extreme" the weighted total would have been 1,536 or the worst possible. Therefore, 357 ÷ 1,536 = 16.7 percent of the worst possible, the overall rating for the period in question.



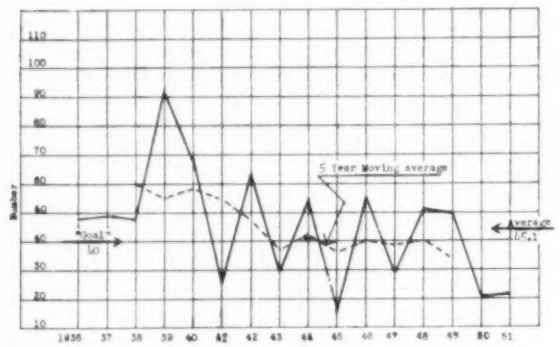
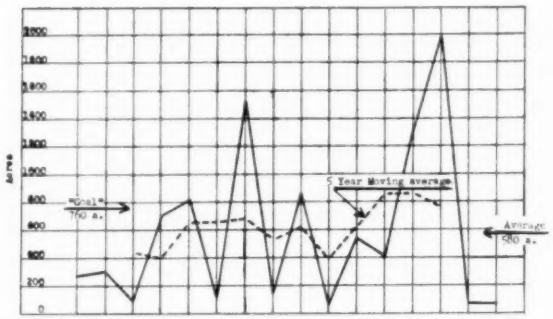


FIG. 1. (*upper*)—Overall seasonal relative severity by years—Chippewa National Forest.

FIG. 2. (*lower*)—Number of fires by years—Chippewa National Forest.



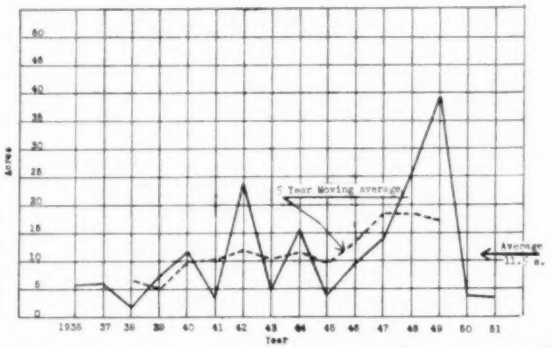
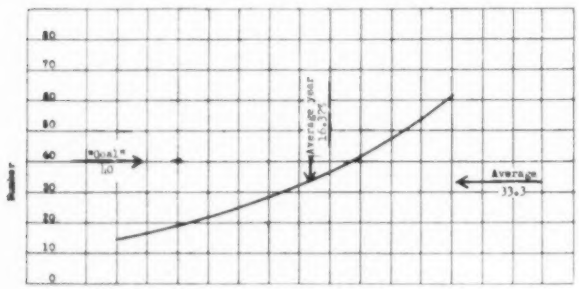


FIG. 3. (*upper*)—Area burned by years—Chippewa National Forest.

FIG. 4. (*lower*)—Average fire size by years—Chippewa National Forest.



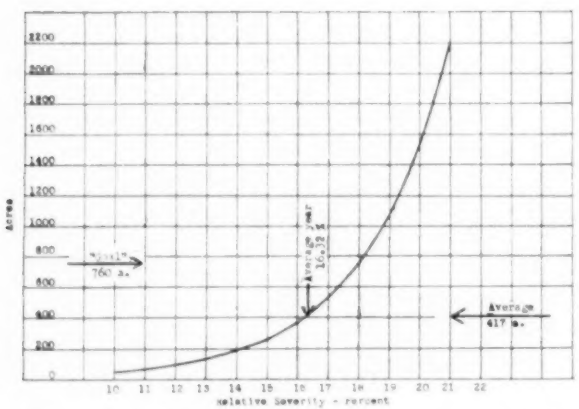
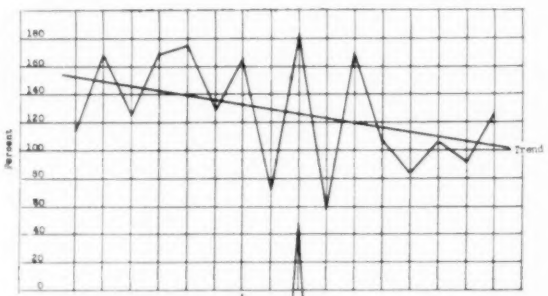


FIG. 5. (*upper*)—Indicated number of fires per year by relative severity—Chippewa National Forest. (Adjusted to 1951 level of risk).

FIG. 6. (*lower*)—Indicated annual burn by relative severity—Chippewa National Forest.



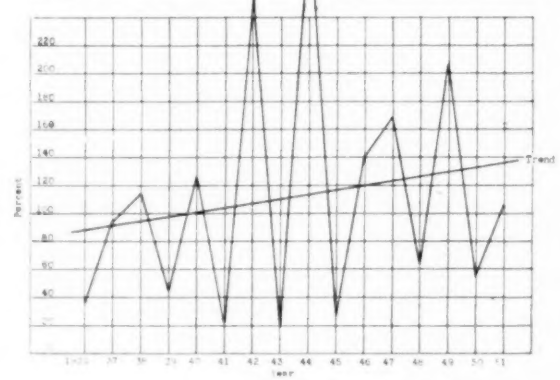


FIG. 7. (*upper*)—Ratio of actual to expected number of fires—Chippewa National Forest. (Adjusted to 1951 level of risk.)

FIG. 8. (*lower*)—Ratio of actual to expected annual burn—Chippewa National Forest. (Adjusted to 1951 level of risk.)

burning conditions and risk allowed for, shows the relative effectiveness of protection in individual years, while chronological regressions of the ratios show the over-all trends (Figs. 7 and 8).

In the case of number of fires the over-all trend is down, indicating a decreasing risk or, by inference, an increase in the effectiveness of prevention effort. For example, the indicated number of fires per year, with burning conditions allowed for, shows an over-all decrease of 19.1 since 1936, or an average decrease of about 1.3 fires a year. It should be noted, however, that while the over-all trend is down, the current trend since 1948 is up, indicating a currently increasing risk or a falling off in the effectiveness of prevention effort (Fig. 7).

In the case of area burned, on the other hand, the over-all trend is definitely up (Fig. 8), indicating a decrease in fire suppression accomplishment. Although still adequate on the basis of present standards, this trend will bear watching since the chance of a "blow-up" increases as the ability to hold fires small decreases. While this trend in area burned could be due to increasing hazard, an unmeasured factor, it could also be due to failures in suppression. Analysis of additional data would be necessary to establish the definite reason.

To properly judge the effectiveness of protection effort a sliding scale is needed. This is provided by Table 2, based on the correlation of number of fires and area burned, with seasonal severity and risk. This table shows the normal annual burn at various levels of seasonal severity and risk. For a year of average severity (16.32 percent) an average of 33.3 fires and a burn of 417 acres is currently to be expected. For the worst year of record (1948), with a seasonal relative severity of 20.79 percent and 51 fires, the burn indicated is 1,849 acres. In 1948, however, only 1,307 acres burned, indicating better than normal protection. In 1949, on the other hand, with a seasonal relative severity of 18.83 percent and 50 fires, 1,979 acres burned or 928 acres more than the average to be expected, indicating that suppression was below par. The specific cause of the poor record in this case was a fire that started outside the forest and got out of hand because of delayed attack.

The values given in Table 2 represent average accomplishment based on past experience in a limited number of cases. Considerable variation from the indicated values is, therefore, to be expected. The correlation of relative severity with area burned, however, is significant; and with number of fires, is highly significant. The values given, therefore, may be taken as indicative of what is normally to be expected under given conditions and excessive departures from them should be investigated for abnormal conditions or administrative failure. Incidentally, it should be noted that better than average performance is called for when the seasonal severity rating goes above 18 percent if the present "goal" of 40 fires and 760 acres burned is not to be exceeded.

While the "goal" of 40 fires and a five-year average burn of 760 acres is a desirable ceiling, it does not provide a realistic basis for judging the effectiveness of fire control effort from year to year since it leaves burning conditions and risk out of the picture. As a result, the standard set is too high in normal years and too low in bad years. The use of a sliding scale such as is provided by Table 2 meets this objection.

TABLE 2.—INDICATED ANNUAL BURN AT GIVEN LEVELS OF "SEASONAL RELATIVE SEVERITY" AND "RISK"—CHIPPEWA N. F. (1936-1951 data)

Risk or number of fires per yr.	Seasonal relative severity—percent												
	10	11	12	13	14	15	16	17	18	19	20	21	
	Indicated annual burn—acres												
10	46	62	82	109	145	193	256	340	452	600	796	1,057	
15	51	69	91	121	161	213	283	376	500	664	882	1,170	
20	56	75	100	132	176	233	309	411	547	726	964	1,280	
25	61	82	108	144	191	253	336	446	593	788	1,046	1,389	below average
30	66	88	117	155	207	274	363	483	642	852	1,132	1,502	
35	71	95	126	167	222	294	390	518	688	914	1,214	1,611	
40	75	101	134	178	237	314	416	553	735	976	1,296	1,721	
45	80	108	143	189	252	333	443	588	782	1,038	1,379	1,830	
50	85	114	152	201	268	354	470	625	831	1,103	1,465	1,945	
55	90	121	160	212	283	374	497	660	877	1,165	1,547	2,054	
60	95	127	169	224	298	394	523	695	924	1,227	1,630	2,163	
65	99	134	177	235	313	414	550	730	971	1,289	1,712	2,273	
70	104	140	186	247	328	435	577	767	1,019	1,353	1,797	2,386	above average
75	109	147	195	258	343	455	603	802	1,066	1,415	1,880	2,495	
80	114	153	203	269	358	474	630	837	1,113	1,477	1,962	2,605	
85	119	160	212	281	374	495	657	873	1,161	1,542	2,047	2,718	
90	124	166	220	292	389	515	684	909	1,208	1,604	2,130	2,827	
	Normal "Risk" or average number of fires per year[1]												
	14.5	16.5	18.9	21.5	24.5	28.0	31.9	36.4	41.5	47.3	53.9	61.5	
	Normal burn for years of average "Risk"—acres												
	51	71	98	136	190	265	373	528	750	1,068	1,528	2,196	

[1]Adjusted to current (1951) level of "Risk," or average number of fires per year currently indicated.

Recreation and Wildlife Problems of the Central Rocky Mountains[1]

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The easy way to discuss recreation and wildlife for the Central Rocky Mountain Region is to review past adventure. Zebulon Pike (5), *George F. Ruxton* (7), *Francis Parkman* (4), *and other explorers passed through the region and wrote about it. We could pretend that their adventures still exist, that those who reside in the area possess their fortitude. We could delude those who admire or envy remnant recreational and wildlife resources of the modern West, into believing that enjoyments surpassing those of other regions are the result of place rather than time or condition—that values are fixed rather than dependent upon ecological factors which can be managed by men. We would be far from the truth.*

RECREATION AND WILDLIFE are beset with problems which retard their management at least two decades behind that of timber-production forestry. To list such problems is simple, for we use hindsight, which someone has said has 20/20 vision. To list solutions is audacious and confronted with controversy. Foresight is partially blind and may be cockeyed.

Problem number one is the difficulty in measuring changing recreation and wildlife values as clearly as those of other wildland resources. This includes inability to parry prevalent statements about "unspoiled" recreation areas and "unlimited" recreation resources. A board foot is assuredly that. Harvested forests can be re-envisioned from their stumps. Grass, too, is rooted, but because it withers yearly, cattlemen argue with range managers from the plains of Colorado to the nation's capitol over range-resource improvement vs. deterioration. But wildlife and recreation resources have no stumps and few permanent forms. Game trails soon dim. Pen and picture preserve only hints of recreational richness. Like music, recreational experiences are fully sensed only during the playing. Most of them become memories, soon buried with men who lived them. These quickly fading evidences explain why wildland recreation is ignored, misunderstood, or lied about, and why game management is chiefly in taxonomical and animal husbandry stages, or is questioned by men of little knowledge.

The most certain way to note changing recreational and wildlife resources is to grow old. Old men have seen change, and regret the passing of that which was good. Some old men are liars who seek status within their imaginations, now that they outlive those who could check their tales. Others speak truly. Parkman (*4*), as an old man in 1892 wrote:

> The sons of civilization, drawn by the fascination of a fresher and bolder life, thronged to . . . western wilds in multitudes which blighted the charm that lured them. . . . The Wild West is tamed, and its savage charms have withered.

Youngsters who seek status, scoff at the tales of oldsters. With undisciplined imagination and burning desire for adventure, they are loath to admit that their chances for adventure are less than their forebears', and neither recognize nor acknowledge important changes. Exceptional young men like Aldo Leopold, Bob Marshall, and their successors, sense in wild lands the past, present, and future; but most consumers of recreation and wildlife resources, see and care only for the present.

"In the land of the blind, the one-eyed man is king." And in a nation of cottontail hunters, or to highly predatory men more aware of immediate advantage than the pageants of history and destiny, Colorado's advertisement (*2*) in September magazines are alluring:

> Get your deer, elk, bear in Colorful Colorado, where visiting hunters averaged more than one deer each in 1952.

Creatures advertised all run away from the hunter. The great beasts which first lured recreationists to this region are nearly gone.

One of the last wild bison herds in the West was destroyed in Lost Park, 45 miles northwest of Colorado Springs, in 1897. Nature's high barriers had kept out the killers until herds easier to reach were obliterated.

Wolves seem extinct in this part of the West, including Yellowstone National Park. The meaning of "impairment," as stated in the National Park Service Act of 1916, was not understood soon enough in the young science of managing national parks, to retain the wolves and mountain lions.

Grizzly bears are extinct in the Black Hills and nearly so in Colorado, but continue in Wyoming's large northwestern national park area. There are no management plans adequate to manage grizzlies in perpetuity, chiefly because no human management plan exists. For grizzlies, human and bear management definitely must be harmonized. A famous hunting exploit of this century was the killing of a grizzly called "Old Mose" on hills south of Pike's Peak. Old Mose had slain at least three men and hundreds of cattle. If hunting for meat or to impress the neighbors, lesser animals than grizzlies will do. If for adventure, the grizzly is America's finest animal.

Indians and their primitive modes of life, which entranced Catlin (*1*) and Parkman (*4*)—and countless others who wrote no journals—are today on reservations, living shabby imitations of white man's life. Some fabricate trinkets—mute and inadequate symbols of a magnificent past—for you to buy. Some dance for your amusement—and for a meal and a passed-hat for themselves. Others forget their dances, and white men's groups

[1]Paper delivered at the general meeting, 53rd annual meeting, S.A.F., Colorado Springs, Colo., Sept., 1953.

preserve them for you. Some pose for pictures which prove on vacation you encountered traces of former adventure.

One of the greatest resources of the old West was its hospitality. Strangers were welcome to food and lodging at remote cabins and ranches. Cowboys out of work in winter "rode the grub line," drifting from ranch to ranch, earning their keep with chores. This hospitality of the "economic province" vanishes from most of today's ranches, especially from those owned chiefly for atmosphere. Most western youngsters do not know what "riding the grub line" means.

The inner resources and rewards of men change in relation to recreation. This was the land of "tenderfeet," fellows unsafe to leave alone with horse, gun, and wilderness. Thoughtless men thus were branded with a contemptuous name until they learned and proved themselves to be thoughtful. Those who were not thoughtful in the early West, met disaster. But today the West is safe for civilization, sport shirts, shorts—and thoughtlessness.

Innocently we made the wonderful places easily accessible; not realizing that we made them safe and readily available for the thoughtless, most of whom know only that (1) they visit places where many desire to go; (2) those with something to sell, tell them they are seeing the genuine thing; and (3) conditions are different from home. The admirable understanding which comes to the intelligent, apprenticed outdoorsman, which makes him self-reliant, cannot readily be made available to the herd. Like Lincoln's concept of respect, the great meaning of outdoor living cannot be demanded, nor served on a platter. It must be earned.

The full value of western recreation and wildlife can never be found along good roads or in rustic hotels. It is found only in past records, in contact with maturing, intelligent outdoorsmen, and in remnant wilderness.

Vandalism is the result of thoughtlessness upon recreational sites. I am nearly convinced that it increases with the square of visitor numbers, rather than in proportion. Can visitors who reveal so much of vandalism carry away a compensating inspiration?

The solution. We need simple, understandable, acceptable quality standards for recreation and wildlife production and harvest. With them we can manage areas to produce high quality recreation. And we can jeer into oblivion the ignorant or deceitful use of "unlimited" and "unspoiled."

Problem number two is the need for adequately financing recreation and wildlife management. For 30 years, with increasing gusto, we have been telling what big business recreation and wildlife are. Hearers and readers are impressed. Legislators were supposed to be, but appropriations do not show it. They figure, and always shall, that Nature will take care of these resources for one more year, while they place the money elsewhere. For recreation areas with few entrances, such as one finds on national and state parks, a gate fee suffices, if geared to inflation. For areas with numerous entrances and exits, the duck stamp and hunting and fishing licenses point the way. I do not blame cattlemen and timbermen for helping to defeat Tackett Bill attempts to attach a percentage of gross national forest income. If I, like they, had contributed that income, I would choose to see if it could reduce my taxes and not be used to subsidize competing uses on the national forests. Furthermore, counties like the one in which I live, with more than 50 percent national forest, must provide recreation and wildlife for more populous counties just east of us, whose residents include few who graze cattle and cut timber from the forest.

The solution. A license or stamp in the possession of every man who hunts or fishes on national forests, or every family that picnics there. This would be equitable. Recreationists need to put up or shut up, and judging by the Pittman-Robertson Act, the Dingell-Johnson Bill, and the reinstitution of a moderate toll on the Pike's Peak Auto Highway, they will dig deep into their pockets, once they know the need.

Problem number three is the eternal conflict about the ownership of land. Spanish land grants in southern Colorado, which took over loosely held Indian lands, were honored when the United States acquired the area. Eastern Colorado and Wyoming, and Nebraska and South Dakota were obtained in the Louisiana Purchase of 150 years ago. Western portions of the Central Rockies were obtained by cession from Mexico. This became the West of free lands. The first free homestead under the Act of 1862 was in central Nebraska. Big ranches were assembled in the '70's and '80's, but always there were open public lands. We seldom have assessed the full value of such lands.

An economic analysis characteristic of business with its present innings, recently listed (*6*) the five laws of "America's economic system:"

1. Private property . . . first and foremost.
2. Freedom in the market place.
3. The natural law of incentive.
4. Competition . . . the spice of life.
5. The umpire in our economic system . . . the structure of law, administered by government.

Overlooked was a sixth law, one under which the nation grew to greatness:

6. Great expanses of space, open to all at prices or efforts everybody could afford to expend; to which pioneers turned for wild meat, berries, honey, fuel, and building materials while their herds and fields multiplied for the market; to which men now turn for adventure as cities rob them of contact with nature, its forces, and harvests.

Such space was a commonly held resource, though within a nation wherein the individual is happiest when he owns his home and place of business. Paradoxically, we pass from the period of generally accepted freedom of enterprise at the precise moment in which we lose these great public spaces, or face their loss under attempts to reduce all lands to private ownership. A certain balance seems essential to

our mental and physical welfare. Truck farms and shops, which epitomize individual domination of land area, have nearly 100 percent personal value and no public value beyond the consumption of products from no one knows or cares where. In contrast, forest and park wildlands possess nearly absolute public values and a minimum of deserved, monopolized personal value.

Despite free homesteading, expanding cities and roads, and false-entry homesteading, extensive public lands remain within this area. Ignorant or dishonest writers blame bureaucracy. Steep slopes, rocks, official weather stations recording as few as 17 days between killing frosts, and low rainfall, explain why these lands were not homesteaded, or reverted after they were. Except to the rancher enjoying wild sports upon his own acreage, the recreational and wildlife richness of the region depends upon these public lands. And always, in this land of extensive public ownership, there have been waterhole traditions. Cattlemen, by fencing or owning waterholes, kept out those who would plow or graze sheep. Now there is recreational waterholing. Landowners charge outdoorsmen, who would reach national forests or state school lands, for the privilege of crossing intervening private holdings. Strange, when laws governing public lands, permit landowners to build access roads free of charge across them! Recently a new type of waterholing looms. People are staking out fraudulent mining claims upon national forests and grazing lands, to control for themselves, and exclude others from, good hunting and fishing.

Compare national forest, national range, and national park lands, which always have been public in the West, with Weeks Law and national park lands of the East; many of which were returned to public ownership after several generations of men had time to make fools of themselves on poor land. These new public lands of the East are popular. Their western counterparts in land status and productivity are not popular, especially during good times.

What is the solution? Time, land-use surveys based upon research, well-informed sportsmen. Perhaps more time, and renovation of musty laws.

Here are a few more soluble problems.

Problem number four can be beavers. No longer popular for felt hats and women's furs, beavers have spread far and wide. Without certain management they eat themselves out of food and quit their workings, but not until their quaint ideas about their own irrigation and that of ranchers has vexed the latter. Shallow thinkers make of the beavers a simple problem: fur value vs. nuisance value. But we learn of their contributions to fisheries, waterfowl production, other wildlife, stable water tables, and range and forest vegetation.

The solution. A beaver research council integrating and stimulating research for the region. This is under way, thanks to the wildlife biologist of Region Two, U.S.F.S., whose dream it was.

Problem number five may be an intolerably efficient control of predators and rodents like prairie dogs. Modern poisons and mechanized coyote-getters, added to steel traps, have silenced coyotes in many areas. More bears are poisoned in some years than are killed by hunters. Prairie dogs favor cottontail populations in the West just as woodchucks do in the east, but no management is based upon the fact.

The solution. Cattlemen in some areas demand protection of coyotes as a partial control of small rodents. Sportsmen need to take more interest in the matter. Perhaps we can separate needed control from efficiency ratings for predator- and rodent-control employees based upon the lives they've taken and the areas they've covered.

Problem number six can be an upsurge in porcupine populations —at a peak in the Black Hills and nearing one in Colorado and Wyoming. Porcupines cannot increase rapidly, for the sexes are of nearly equal numbers and births are single. But with intensified control of mountain lions, bobcats, wolves, coyotes, and other predators during the last 30 years, they occasionally produce destructive populations. *The solutions are simple:* Anti-porcupine campaigns among wildland managers. Assuring the public that porcupines are not protected and should be killed where numerous.

The climate can be problem number seven. The climate is generally desirable—dry, sunny, and often exceptional—despite the cloud seeders who have excuse for working here. But it is generally misunderstood by people from states with less range in altitude, who think of weather as a latitudinal rather than vertical phenomenon. With five life zones decked one above the other within a few miles, outdoorsmen who thoughtlessly dress in the morning for the Upper Sonoran Zone, chill that night in the Canadian or Hudsonian. A clear atmosphere and the lure of distant peaks combine to start pilgrimages beyond ability to accomplish within allotted times. *The solution:* Mark Twain is the only man who ever did much with the weather. If it will not adjust to you, learn to get along with it.

Problem number eight is the need for research, flexibility, and public confidence in game management. The mule deer, which 30 years ago paused within range to see what startled him, has grown wary and so numerous that problem areas develop until management is flexible enough in respect to seasons, bag limit, and sexes, to harvest the increase. Pronghuck antelope, which men predicted in 1920 would become extinct, now are managed in numbers proportionate to non-irrigated and unplowed range available. The numbers of wapiti are limited chiefly by the amount of winter range which an expanding agriculture has left.

Bighorn sheep have been regularly harvested under limited license since the early 1920's in Wyoming, in its great northwest complex of national forests, parks, and wilderness areas. This year (1953), Colorado

has its first season upon big-horn sheep since 1885. As always when a new season, even with a restricted harvest, is opened, the public becomes alarmed, and vocal. But as the season wears along, we who slowly planned it through many years, feel like saying: "We told you so." *The solution:* More research, more flexibility of management, and growing public confidence as the profession matures and proves its worth.

Problem number nine is how much development we need and can stand. Agriculturists want more acreage. Business men want more consumers. Politicians want more of everything the voters seem to want. The Bureau of Reclamation and Corps of Engineers seldom have found lands in which so many dams could be built. Irrigation and dry farms rid the region of the "Great American Desert," though dry farming on the once-sodded plains brought the "dust-bowl" of 1934 and, in states south of us, another in 1953. Both agricultures drove out the white-tailed jackrabbit, the antelope, and native gallinaceous birds. Asiatic pheasants are numerous on irrigated grain lands. The black-tailed jackrabbit maintains fair numbers on the dry lands, though nothing like the numbers reached before his flesh and pelt were sold for tankage, mink food, and felt. Irrigated lands will never cover a major portion of the region, but reservoirs flood valuable farm lands and game winter-range. Concrete lined ditches trap and drown deer. Fluctuating reservoirs replace once famous trout streams. Reservoirs plus fishing contests, means that fishermen, though they prefer streams, haunt the reservoirs in hopes that a fish large enough to win a deep-freeze or jeep will take the hook. Transmountain diversions destroy streams famous for fishing and scenery, hybridize fish long separate in different watersheds, and may introduce new diseases. The sea lamprey, now in the Great Lakes, may extend its destruction to all inland waters through transmountain diversions.

Increasing human populations, ease of transportation, and reduced game ranges explain higher non-resident license fees and more big game upon a limited license basis. They explain why creel limits in Colorado this year were reduced from 20 to 10 fish. Naturally there are more "keep out" signs and less generosity. *The solution:* Standards of recreation and wildlife quality; the realization through hindsight that we lose recreational values; more ecological thinking and education.

Problem number ten is adventure. What was meant by "Man shall not live by bread alone?" What was meant by "Woe unto them that join house to house, that lay field to field, till there be no place, that they may be placed alone in the midst of the earth"? Do people need a West? Someone writes "The West is still wild," and people want to believe it. Adventure is one of man's principal combined needs of mind, body, and soul. Note how much of adventure —as shown in motion picture, television, and frontier days — is staged in the primitive west, where aborigines, climate, and topography abolished the weak and foolish, but permitted the daring and wise to endure.

Men talk of adventure in microscope, test tube, and factory; but forget that wine, women, song, and wildland adventure call to nature's still primitive—and that all save wildlands are handy. How blindly we damn the adventures of sailors in foreign ports, with too little time ashore to go beyond town to wildland adventures of a wholesome type!

Call it what you will—atavism, the legend of Antaeus, man's need for a return to the primitive—Leopold wrote (3): ". . . we shall do well to persist as a species at the end of the time it would take to outgrow it." Man is more a creature of the wilderness and frontier than of modern civilization. His body was shaped by primitive environments and brought to the modern world little changed. His music was shaped by instruments devised to imitate sounds of the wilderness to which his ears are receptive. His mind and early government were outgrowths of wilderness and frontier environments. Man never has gone far beyond the wilderness. Nations and civilizations much removed from the wilderness and its simple behavior soon crumble. How many more civilizations will rise and fall, and our children with them, before man achieves the complex ecological thinking essential for living with assurance under civilization?

Change this part of the West as you will, agriculturally, industrially, and financially it will always be second rate in contrast with Iowa, Pittsburgh, and Wall Street. Change it intelligently, and it will have wildlife and recreational attractions second to few places in the world. Except for recreation and wildlife this was long a by-passed region. The 1849ers hurried through to California in their quest for gold. "Pike's Peak or bust" and Colorado gold rushes came a decade later. Loggers sneered at our "kindling" on their way to the huge timbers on the West Coast. But those who sought outstanding recreation and wildlife tarried here and gave Colorado Springs the nickname of "Little Lunnon" in its early decades. *The solution* is to keep these things in mind as we plan change during the time in which we reduce philosophies about the good life, the good economy, and good government to sciences which can guide us without destructive conflict, internal or international. And we should hurry.

The final problem can be a horse problem. This is the West of song, story, and modern advertising. Horses, horse equipment, and horsemen's clothing are its motifs. Three-toed horses once ranged here, but became extinct before Spanish explorers reestablished horses and gave mobility to Indians and cowboys. Western businessmen in horsemen's clothes greet eastern delegations at depot and airport. Even some ranchers play cowboy. Western stores are full of cowboy clothes—but it does not pay most Colorado, Wyoming, and Black Hills citizens, or most tourists, to

learn to ride a horse. Motor roads take you most places you want to go. Few of those who hire themselves and their horses to provide transportation into back country, have learned how to spend more than the summer making a living. Their prices are high—often unreasonably so—and the jeep takes over. Western clothes are no longer the climate- and horse-dictated garments of cowboys. Today they parade the styles of rodeo performers. If these remarks stir regret and resentment—and I hope they do—credit your feelings to fundamental human need for adventure, which we have considered. Realize also that to have horsemanship, we must have horse country.

Conclusions

These sample problems indicate general failure to manage interrelated recreation and wildlife resources with gratifying skill. And I doubt that we shall achieve effective management until three measures are instituted:

1. Establish qualitative and quantitative objectives of management. Simple, understandable, acceptable quality standards for recreation and wildlife production and harvest are the first need. Then standards of quantity can be fixed.

2. End habits of speech and thinking which imply that management is not needed. We must no longer use the words "unlimited" or "unspoiled" to describe wildlife recreation; just as we abandoned these words when timber resources were placed under management.

3. Fit consumption to productivity. Limit recreational use to what land productivity and quality of recreation desired can withstand.

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Western Hemlock. From the painting by Franklin Arbuckle, commissioned by the Canadian Pulp and Paper Association. One of a series of forest scenes by distinguished artists, depicting the chief forest species presently harvested by that industry for pulpwood.

Growth Rate and Specific Gravity in Conifers[1]

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FEW SUBJECTS in forestry have attracted so much interest over so long a period of time as the influence of growth conditions on specific gravity of dry wood substance. Few subjects are so little understood by present-day foresters. Despite the large amount of research in the field, there is apparently no adequate summary of the findings. Writers in the United States, Germany, South Africa, and elsewhere have presented diametrically opposite views within recent years. Wood technologists and silviculturists have approached the same problem with different points of view, different techniques, and, frequently, different conclusions.

This paper, based upon a thorough study of the literature and upon original investigations on jack pine, (*Pinus banksiana* Lamb.) is an attempt to clarify this important subject insofar as conifers are concerned.

Historical

Speculation concerning the weight of wood dates back to the very first treatise on trees. Theophrastus, writing in the third century B. C., noted that "it is true of all trees anywhere that with a north aspect, the wood is closer and more compact and better generally." This concept that narrow rings are indicative of higher density and better quality has persisted to the present day.

Measurements of wood density are recorded from the beginning of scientific interest in forestry in the eighteenth century (Chevandier and Wertheim, 1848). In 1762, Musschenbroeck found that "the densest wood is found in a place intermediate between the pith and the bark, and the part near the sapwood much exceeds in solidity that near the heart." Duhamel du Monceau in 1780 studied a variety of species and concluded among other things that "wood at the base of the tree is heavier than that in the crown," and that "when trees are vigorous and still growing strongly, it is the heartwood which is the densest; and in the large trees which are beginning to decline, the heartwood is often lighter than that between the heart and the outside."

Spurred by the conflicting statements of Duhamel and those previously made by Buffon concerning oak, Chevandier and Wertheim (1848) conducted extensive tests on the specific gravity and strength properties of French species. Their studies were carried out with specially-designed testing apparatus, and their carefully tabulated findings represent perhaps the birth of the modern science of wood technology. Several of their conclusions are pertinent to the present discussion:

> [7.] The mechanical properties increase in a constant manner, and sometimes very markedly, from the center to the circumference, for fir whatever its age, for pine, hornbeam, ash, elm, maple, sycamore, poplar, alder, and in part for acacia. This increase appears to be independent of age for conifers. . . .
>
> [8.] For each annual ring, taken separately, the mechanical properties diminish with height in the tree; it is the same in directions perpendicular from the axis.
>
> [10.] There is no regular relationship between density and age, ring width, exposure, and the nature of the terrain.
>
> [13.] The relative thickness of the rings cannot be considered as the prime cause of the differences that one observes in the same tree, nor of those which exist between trees. It is true that, in fir, the gradual diminution of the rings progresses most often in the same direction as the increase in proportion from the center to the circumference; but, in the case where the contrary has taken place, this increase in properties is equally pronounced.
>
> [16.] In the same tree, the various mechanical properties progress always in a parallel fashion. Thus, the densest annual ring is ordinarily that which possesses also (the greatest strength properties).

The conclusions of Chevandier and Wertheim have, in general stood the test of time. Following their investigations, however, interest in wood density shifted from France to Germany and Austria. A general text by Nördlinger appeared in 1860. Beginning with a series of papers by Robert Hartig (1869 to 1901, and especially 1885), Bertog (1895), Omeis (1895) and Schwappach (1897-98), many detailed studies sought to relate specific gravity to age, crown class, site quality, and growth rate. These papers are not listed in the bibliography because they are summarized in German by Exner and Janka (1925), Trendelenburg (1939), and Kollmann (1951) among others, and to some extent in English by Fernow (1892), and Büsgen and Münch (1929). The survey by Trendelenburg is especially complete and worthy of study.

In North America, investigations suggested by Fernow (1892) were begun by Johnson at that time. In 1896, Johnson and Roth reported that, for southern pine, "in any one tree the wood is lighter and weaker as we pass from the base to the top," and that the interior of the butt log has low specific gravity.

Beginning with Sterns in 1918 and Hale and associates in 1923, various Canadian studies have related growth properties to wood density. Paul in 1924 initiated a long series of investigations by himself and associates at the U. S. Forest Products Laboratory. Finally, Turnbull published the first of his South African papers on the subject in 1937, a series which has stimulated other work throughout the British nations. Few of the many papers, however, reveal more than a sketchy search of the work done by earlier scientists, particularly in other countries.

Measurement of Specific Gravity

Specific gravity may be easily determined by a variety of methods. The conditions under which the measurements are taken must be

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standardized, however, and the precision of measurement must be ascertained before valid conclusions can be drawn. True specific gravity of dry wood, based upon oven-dry volume and oven-dry weight, has many advantages from the standpoint of wood technology. In approaching the problem from an ecological standpoint, however, specific gravity based upon wet volume and oven-dry weight is preferable. Its use permits weight determinations of the standing tree; it is an easily replicable value; and its use avoids the complications arising from wood shrinkage while drying. All specific gravity values given in the present paper are, therefore, based upon wet volume and oven-dry weight.

The number of specific gravity samples can be greatly increased if increment borings can be used. Markwardt and Paul (1946) compared specific gravities obtained from increment cores with values obtained from standard 2 by 2 by 6 obtained from standard 2 by 2 by 6 inch blocks. The mean of 50 core readings for mahogany was 0.548 compared with 0.560 for the blocks. For khaya, the means were 0.486 and 0.491 respectively. In both cases, the core readings were lower, but the differences were not significant statistically. Bethel and Harrar (1948) developed a mercury volumeter for increment cores which gave results comparable to those obtained by water displacement.

Increment core determinations were further tested in the present study. In a 38-year-old (from seed) jack pine plantation at Lake Vadnais (near St. Paul) increment borings were taken at 3 different heights on each of 14 trees. The mean specific gravity of the cores (0.370) was slightly but significantly lower than the mean specific gravity of wood blocks cut out around the core holes (0.380). The standard error of the difference was 0.003, indicating satisfactory conformance of the two types of samples. The lower specific gravity of the cores could either be due to better moisture removal from the cores than from the surrounding blocks, or to increased dimension of the cores resulting from release from compression in the tree. There was no evidence that the increment borer compressed the cores. In fact, the increment core specific gravity determinations seemed more probably correct than those obtained from the blocks because of the difficulty of extracting all the moisture from the blocks and the difficulty of cutting the blocks so as to eliminate knot wood, compression wood, and other defects which tend to increase specific gravity.

In the present study, increment cores were placed in vials containing water immediately upon collection. Thereafter, they were not touched by hand but were manipulated with tweezers. Volumes were determined in the wet condition from micrometer measurements of three diameters (at each end and in the center) and two measurements of length. Weights were obtained by use of dessicated weighing bottles on a precision laboratory balance. Repeated careful measurements of 16 Scotch pine (*Pinus sylvestris* L.) cores furnished information on the precision of the method. For diameter measurements, no difference was found between the diameter of the cores parallel to the fibers and perpendicular to the fibers. The mean difference between diameter measurements repeated after a six-day storage in water was only 0.01 percent of the mean core diameter of 0.429 centimeters. The mean difference between the length measurements was 0.024 centimeters or 0.6 percent of the mean length of 4.1 centimeters. The mean difference in volume was 0.004 cubic centimeters or 0.6 percent of the mean volume of 0.59 cubic centimeters. Weights were not so accurate, however, due to the fact that the cores retained some moisture after 24 hours in the drying oven and even a 48-hour drying period did not lead to completely replicable results. The mean difference in weight was 0.002 grams or 1.0 percent of the mean weight of 0.225 grams. The mean difference in the specific gravity determinations made 6 days apart was 0.0018 or 0.47 percent of the mean specific gravity of 0.382. Storage in water did not affect the volume of the cores significantly, but the second drying of the cores gave lower dry weights than did the first. An improvised water-displacement volumeter gave core volumes comparable to but less precise than those obtained from micrometer measurements. All in all, increment cores apparently give satisfactory and precise specific gravity values when handled under controlled laboratory conditions.

The method of obtaining wood samples for specific gravity determinations may vitally affect the results obtained. In wood technological studies, where test blocks of uniform size are essential, they are usually cut from cross-section disks of trees in a pattern similar to that illustrated in Figure 1A. The mean specific gravity of such blocks, however, is not the mean specific gravity of the tree. The block at the center samples the entire pith area, but the four outermost blocks sample only a small proportion of the outer growth rings. Since the pith area is usually low in density while the outer ring area is relatively high in density, averaging the specific gravity of the sample blocks will ordinarily result in too low a specific gravity for the entire tree.

In ecological studies where it is desired to determine the specific gravity of the entire tree, the wood samples should be taken so as to be proportional to the volume of the tree. The cross-sectional area of a disk cut at any height is closely proportional to the tree volume. The specific gravity samples, therefore, should be cut so as to accurately sample the cross-sectional area. For small stems, the entire disk may be used. For larger stems, the sample should be of even thickness and should be limited on the sides by radial cuts extending from the pith to the outside (Fig. 1B). Such radial sections will ordinarily have a higher specific gravity than would be obtained from test blocks of uniform size, and are unbiased samples for determining the mean specific gravity of the tree. The difference may be of low order, however. For 42 jack pine disks from 14 Lake Vadnais 38-year-old trees, the mean specific gravity of the radial blocks was 0.3812 com-

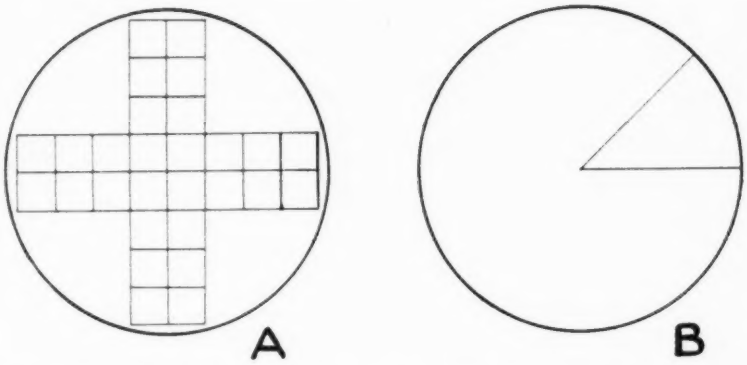

FIG. 1.—Sampling of wood for specific gravity determinations. *A*. Standard test procedure. *B*. Sampling in proportion to tree volume.

pared to 0.3797 for adjacent rectangular blocks cut from pith to bark.

What Determines Specific Gravity

Before investigating factors affecting specific gravity, it is well to consider briefly the known anatomical basis of specific gravity as summarized by such works as Trendelenburg (1939) and Kollman (1951) based largely upon earlier German, American and Canadian sources.

The specific gravity of basic wood substance, (holocellulose and lignin) varies but little and averages about 1.5. Variations in specific gravity between species and within a tree are largely the result of differences in pore volume and the presence of extraneous materials such as resins and gums. Summerwood, because of the small size of the lumen, is much denser than springwood. In the normal sapwood of conifers, the mean specific gravity of summerwood for various species usually ranges between 0.6 and 0.9; while that of springwood is from 0.25 to 0.32. Within a given species, the summerwood averages 2 to 3 times the density of the springwood. The range in specific gravity within each of four southern pines was studied by Schrader (1932) who found that springwood varied mostly between 0.20 and 0.35 while summerwood varied largely between 0.35 and 0.85.

In compression wood, the lumens are relatively small in the springwood and large in the summerwood. Specific gravity is relatively high, therefore, in springwood (about 0.32 to 0.40) and relatively low in the summerwood (about 0.50 to 0.75). Because of the high proportion of springwood, though, compression wood is usually much heavier than adjacent normal wood. Knot wood, with its high proportion of summerwood and compression wood, is very high in density.

Extraneous substances such as resin are usually lighter in specific gravity than basic wood substance, but they fill the lumens and intercellular spaces of wood, thus raising the specific gravity. Heartwood, therefore, generally has a measurably higher specific gravity than sapwood (Peck, 1933; Kalnins, 1930; Turnbull and Du Plessis, 1946; Hirai, 1949). Due to the complicating effect of age, heartwood-sapwood comparisons should be based upon rings near the boundary separating the two zones. Hirai (1951) has found that, as wood changes from sapwood to heartwood, the specific gravity of the springwood increases due to infiltration of extraneous substances, while that of summerwood decreases.

The high correlation between percent summerwood and specific gravity has been repeatedly demonstrated during the past century. For example, Schafer (1949) has noted that, for 606 southern pine cross-sections, 72 percent of the variation in specific gravity could be attributed to changes in the volume of summerwood. Since percent summerwood can be estimated visually, it has been used widely as a rough index of density. The practical values of percent summerwood, though, should not obscure the basic fact that it is but one of a series of factors affecting specific gravity. To fully explain variations in specific gravity, it is necessary to study (1) the chemical composition of the wood, including extraneous substances; (2) the variation in the size of the lumen, a factor which in itself is related to the length and diameter of the tracheids; and (3) variation in the thickness of the cell wall.

Effect of Position in Tree on Specific Gravity

Specific gravity is known to vary greatly within the tree according to height, radial position outward from the pith, age of the annual ring, and other factors. In fact, the variation in density within the trees is often greater than that between trees. Failure to take in account this variation in density within the tree may well confound or otherwise obscure the effect of growth conditions on specific gravity.

Variation with height.—It has long been known (since Duhamel du Monceau, 1780) that, for many conifers, specific gravity decreases with height in the stem. Sanio (1873) demonstrated that the percent summerwood decreased with height in Scotch pine and Robert Hartig showed that the density similarly decreased. This general truth has since been amply demonstrated for a large number of pines, eastern hemlock, Douglas-fir, European larch, and other conifers.[3]

In the case of jack pine, the species under particular study in this paper, the decrease in specific grav-

[3]Among recent references being Johnson and Roth (1896); Sterns (1918); Myer (1930); Bray et al. (1930, 1937, 1939, 1940); Kalnins (1930), Kalnins and Liepins (1938); Luxford and Markwardt (1932); Schrader (1932); Lodewick (1933); Brust and Berkley (1935); Turnbull (1937, 1938, 1942); Chidester et al. (1938, 1939); Trendelenburg (1939 book summarizing previous papers dating back to 1934); Volkert (1941); Paul (1941, 1950); Jalava (1945); Olson, Poletika and Hicock (1947); Anon. (1948b); Lindgren (1949); Wangaard and Zumwalt (1949); and Hughes and Mackney (1949).

ity with height is pronounced. Chidester, Bray, and Curran (1939) analyzed wood samples from a 48-year-old jack pine stand in Minnesota and found that the mean specific gravity was 0.385 at the top of the tree, 0.392 in the middle of the bole, and 0.416 at the butt. Similar results were obtained from the fourteen 38-year-old jack pine analyzed in the present study (Table 1). The mean specific gravity was 0.358 at 11 feet just under the crown, 0.369 at 6 feet, and 0.389 at 1 foot. The variation was highly significant according to analysis of variance (Table 2).

TABLE 1.—EFFECT OF POSITION IN TREE ON SPECIFIC GRAVITY IN 38-YEAR-OLD JACK PINE.

Growth rings (age)	Height above ground (feet) 1	6	11	Mean
26-30	0.410	0.389	0.368	0.389
21-25	.399	.376	.363	.379
16-20	.389	.363	.344	.365
11-15	.384	.346		.365
6-10	.365			.365
Mean	0.389	0.369	0.358	0.375

In certain conifers, notably the spruces, the specific gravity does not markedly decrease with height, but rather does not vary significantly or may even increase with height. This negative relationship has been noted for white spruce (Hale and Fensom, 1931), eastern white pine (Burger, 1929; Myer, 1930), and Norway spruce (Trendelenburg, 1939; Turnbull, 1942; Jalava, 1945; Olson, Poletika and Hicock, 1947). Although heavy wood may be laid down near the periphery at the base, it is averaged out by low density wood laid down near the pith at the same height. The summerwood layer is neither distinct nor pronounced in these species. Volkert (1941) and Turnbull (1942) have independently shown that the lack of a specific gravity gradient is associated with a high degree of taper in these trees (see also Bryant, 1950). In fact, the more cylindrical the tree, the greater will be the decrease in specific gravity with height, even within a given species. Marts (1949) confirmed this for longleaf pine by showing that for pruned trees, taper decreased while the mean specific gravity increased. These findings, coupled with the observation that trees braced against swaying put on lower specific gravity wood than they would otherwise (Anon. 1948a), seem to indicate that the density of wood laid on at a given point in the tree is a function of the stresses placed upon it.

TABLE 2.—ANALYSIS OF VARIANCE: EFFECT OF POSITION IN TREE ON SPECIFIC GRAVITY.

Source	Degrees of freedom	Sum squares	Mean squares	F
Total	153	282,831		
Between trees	13	160,047	12,311	26.42 h.s.
Between positions	11	62,644	5,695	12.22 h.s.
Heights	2	28,237	14,118	30.30 h.s.
Ages	4	17,059	4,265	9.15 h.s.
Interaction	5	17,348	3,470	7.45 h.s.
Error	129	60,140	466	

Variation with horizontal position and age.—Specific gravity also changes with distance outward from the pith at any one height. For young and semi-mature trees, specific gravity is almost always found to increase from the center outward.[4] This relationship holds true for the jack pine analyzed in the present study (Table 1). At 1 foot from the ground, the mean specific gravity of 14 trees varied from 0.365 for the middle 5 rings to 0.410 for the outermost 5 rings. The difference was highly significant by analysis of variance (Table 2).

In mature and overmature trees, however, there is a tendency for the outermost wood to be lighter in specific gravity than that laid down earlier. For most conifers studied, wood density declines after the trees are about 100 years old. Examples have been furnished for Scotch pine and other European conifers (Schwappach, 1897-98; Kalnins, 1930), southern pines (Paul, 1930; Brust and Berkley, 1935), redwood (Luxford and Markwardt, 1932); and Douglas-fir (Paul, 1950).

Although the trend of specific gravity with distance from the pith is clearly established, it is impossible to say whether this trend is related to position in the tree or to age. The two factors are completely confounded. The farther out the growth ring from the pith in a given tree, the greater is the age. Wood technologists interested in timber mechanics have tended to emphasize position in the tree; silviculturists have been given to assume the relationship is due to age. The relative importance of position and age cannot be ascertained in a single tree, but can only be approached by specially-designed experiments involving trees in which the wood at the same position is of different ages.

Effect of Growth Rate on Specific Gravity

Gross growth rate.—Many investigators have curved specific gravity over the width of the growth ring and obtained a gross correlation.[5] Such curves are generally only approximate as the spread of the data is very wide and the degree of correlation is poor. For example, Schafer (1949) found that only 31 percent of the variation in specific gravity in southern pines could be attributed to the gross variation in ring width; while Kraemer (1950) found that, for red pine, only 28 percent of the variation could be similarly taken into account.

The gross correlation between ring width and specific gravity is of value in grading lumber and in other wood technological studies. It is of no value, however, in determining the effect of growth upon

[4] See most of references in footnote 3 and Burger (1929); Scott et al. (1947, 1951); Alexander (1950).

[5] Among recent references, see Hale and Brophy (1923); Hale (1924); Hale and Fensom (1931); Paul (1930); Rochester (1933); Alexander (1935, 1950); Trendelenburg (1939); and Volkert (1941). Caution must be exercised in comparing curves using rings per inch and curves using ring width as the choice of the variable affects the shape of the curve. Ring width is preferable.

specific gravity, because it also measures but does not separate the effects of position in tree and of age. A tree tends to put on an approximately equal amount of cross-sectional area each year as long as its growing space remains constant. The larger the tree, the narrower will be the annual growth ring containing this area. In other words, ring width gradually decreases from the pith outward for the normal tree. If test samples are cut from a given height in the tree, a gross correlation will be found between ring width and specific gravity. It is impossible to tell, however, whether the gradient in specific gravity is due to (1) ring width, (2) age, or (3) horizontal position in the tree, because all three factors normally vary together.

A similar confounding occurs with changes in height. Any given annual ring tends to increase in width with increasing height. It is impossible to tell, however, whether the gradient in specific gravity with height is due to (1) ring width, or (2) height. If samples from various positions in a tree are grouped together, therefore, the variation in specific gravity is related to a series of confounded factors.

Various attempts have been made to isolate the various confounded factors discussed above. Perhaps the most successful have dealt with the effect of age (or horizontal position) as segregated from that of ring width. For example, a number of investigators[6] have shown that older wood has a higher specific gravity than younger wood having the same average ring width.

Still other investigators have gone a step further and have demonstrated that specific gravity increases with age (or distance out from the pith) regardless of whether the ring width increases or decreases. Chevandier and Wertheim found this in 1848, while Turnbull (Turnbull and Du Plessis, 1946; Turnbull, 1947) has emphasized the same relationship in recent years for exotic pines in South Africa. It seems clear that the age or horizontal position has a much greater effect on specific gravity than ring width in a given cross-section, and that much of the gross correlation found between ring and width and specific gravity is really a measure of correlation between age and specific gravity resulting from failure to hold wood age constant in the experiment.

Whereas the effect of age or horizontal position on specific gravity is pronounced and has been thoroughly demonstrated, much less success has been had in efforts to show the importance of growth rate on specific gravity. Investigators who have tested variations in growth rate while holding position of sample in tree and age of wood in sample constant, have for the most part obtained negative results.[7]

Similar negative results were obtained for jack pine in the present study. Two stands in Itasca State Park (Minnesota) were sampled. Increment borings were taken in 96 trees in a 57-year-old stand east of Douglas Lodge and in 48 trees in a 70-year-old stand west of the source of the Mississippi along the north boundary. All borings were taken at breast height. In the 57-year-old stand, the outer three annual rings were cut off to avoid possible compression of these succulent layers. The next 20 annual rings (i.e. ages 34-54) were included in the specific gravity sample. In the 70-year-old stand, the three outer annual rings were again removed, and the next 30 annual rings (ages 37-67) were sampled. All cores were taken in July, 1951 and were placed immediately in a vial of water. Measurements were made by the micrometer and precision weighing techniques described above, and are thought to yield specific gravity values with an accuracy of 0.5 percent.

TABLE 3.—EFFECT OF GROWTH RATE ON SPECIFIC GRAVITY

	57-year stand	70 year stand
Mean values		
Specific gravity	0.388	0.406
D.b.h. (inches)	9.58	9.42
Ring width (mm.)	1.36	1.10
Rings per inch	18.7	23.0
Correlation between ring width and specific gravity	0.036	0.010
Correlation between d.b.h. and specific gravity	0.045	—0.024
Number of trees sampled	96	48

Since height above ground and age of the annual rings were held constant, the tests should show the effect of growth rate on specific gravity as independent from the effect of position in tree on specific gravity. The correlations obtained, however, were of absolutely no significance (Table 3). Neither ring width nor stem diameter accounted for more than a minute fraction of one percent of the variation in specific gravity (as measured by the square of the correlation coefficient).

The tests did, however, confirm the important effect of age on specific gravity. The cores from the 70-year-old stand (average age of wood in core, 52 years) had a mean specific gravity of 0.406. Those from the 57-year-old stand (average age of wood, 44 years) had a mean specific gravity of 0.388. Comparable core samples from the 38-year-old jack pine stand at Lake Vadnais (average age of wood, 28 years) had a mean specific gravity of 0.363. Age has an obviously strong effect on specific gravity, therefore, in material which shows absolutely no relationship between ring width and specific gravity.

These generally negative results do not necessarily indicate that rate of growth has no effect on specific gravity. Rather, they imply

[6] Hale and Fensom (1931) showed that 140-year-old white spruce had a higher specific gravity than 85-year-old trees having the same average ring width. Luxford and Markwardt (1932) found that virgin redwood had greater density for the same ring width than did second-growth. Alexander (1950) found the same relationship for 60- and 90-year-old and virgin growth Douglas fir.

[7] Representative studies include Chevandier and Wertheim (1848); Hartig (1885); Janka (1913); Harlow (1927); Klem (1930) as cited by Lodewick (1933); Lindgren (1945); Hirai (1950); Anderson (1950).

that rate of growth has far less effect on specific gravity than position in tree and age of the wood. In order to study the effect of growth rate on specific gravity more precisely, it is necessary to standardize upon a single well-defined age and position in the tree, and then to determine variation in specific gravity with variation in growth rate. It is further desirable to segregate growth effects due to site from growth effects resulting from stand density, because valid silvicultural recommendations cannot be formulated without knowing the factor that determines ring width.

The size and crown class.—For immature trees of the same age, the largest or dominant stems usually have the lowest average specific gravity while the smallest or suppressed stems usually have the highest average specific gravity. This general trend has been amply demonstrated in a long series of European papers beginning with Robert Hartig (summarized by Trendelenburg, 1939), and by other recent studies (Paul, 1932; Volkert, 1941; Jalava, 1945; Anon., 1949).

Thus it would seem that, if age is held constant, the faster the growth rate (resulting in bigger trees and greater dominance), the lower would be the specific gravity. For example, Paul (1927) compared 5 open-grown longleaf pine with 5 adjacent forest-grown pine of the same age (25 years old), and found that the outer growth rings in the forest-grown trees had the higher specific gravity. Bray and Paul (1932) studied three longleaf pine plots (30-35 years old) thinned to different intensities, and found that the plot having the highest mean diameter had the lowest mean specific gravity.

Although the relationship between stem diameter or crown class and specific gravity very likely exists, it is by no means a strongly defined one. Various investigators have failed to find any consistent and clearly-defined correlation between stem diameter and specific gravity, or between crown class and specific gravity (various papers cited by Trendelenburg, 1939; Anderson, 1950). Bethel (1947) similarly failed to find any correlation between stand density (a variable related to tree size and crown class) and specific gravity in loblolly pine; while Marts (1950) found that longleaf trees planted at a 6 by 12 foot spacing actually had a higher specific gravity than trees of the same age planted at a 4 by 6 foot spacing.

The present study is a case in point. For the 144 jack pine sampled in two different stands at Itasca State Park, there was absolutely no correlation between stem diameter and specific gravity (Table 3) or between crown class and specific gravity (Table 4).

The apparent divergence of findings may be explained by the distribution of specific gravity in stems of the various crown classes as illustrated by Trendelenburg (1939), Volkert (1941), and Jalava (1945). From these detailed studies, it is apparent that dominant trees lay on light-weight wood in youth, but that this wood is concentrated near the center of the tree. In middle age, trees of all classes put on relatively heavy wood, which varies in density according to position in tree. In old age, dominant and codominant trees continue to put on relatively heavy wood, while the slower-growing stems begin to put on lighter wood. Thus, if young trees are studied (as in the Paul papers cited), a high correlation will be found between crown class or stem diameter and specific gravity. If, however, the specific gravity samples are taken so as to exclude the central core of the tree (as in the Itasca jack pine samples), and if age is held constant, no such relationship is found. In old timber, finally, the relationship between crown class and specific gravity may even be reversed because of the lower density wood put on in the outer layers of slowly-grown conifers. Both the age of the tree and the method of sampling the tree, therefore, may affect this general relationship.

The volume production of specific

TABLE 4.—EFFECT OF SITE AND CROWN CLASS ON SPECIFIC GRAVITY OF JACK PINE: ANALYSIS OF VARIANCE

Source	Degrees of freedom	Sum square	Mean square	Significance
57-year stand				
Total	95	96,108		
Crown class	2	52	26	None
Site	3	435	145	None
Interaction	6	548	91	None
Error	84	95,073	1,132	
70-year stand				
Total	47	59,656		
Crown class	2	316	158	None
Site	2	1,193	596	None
Interaction	4	215	54	None
Error	39	57,932	1,485	

TABLE 5.—VOLUME PRODUCTION BY SPECIFIC GRAVITY CLASSES FOR SCOTCH PINE[1]

	Dominant	Codominant	Intermediate
D.b.h. (inches)	8.9	6.6	4.6
Basal area (square feet)	0.43	0.24	0.12
Height (feet)	83	71	61
Volume (cubic feet)	15.86	8.18	3.15
Volume by specific gravity classes			
0.38	1.03	0.07	
.40	3.35	0.50	
.42	3.04	2.58	0.02
.44	2.40	1.01	0.38
.46	1.98	1.23	0.70
.48	1.50	1.00	0.73
.50	0.74	0.35	0.42
.52	1.19	1.01	0.37
.54	0.63	0.26	0.39
.56		0.17	0.14

[1]Original calculations based on data published by Jalava (1945) for 90-year-old Scotch pine on medium-poor (*Vaccinium*) site in Finland.

gravity classes is shown for 90-year-old Scotch pine in Finland in Table 5. The dominant tree has by far the largest volume of low specific gravity wood and consequently the lowest average specific gravity. It has also, however, the largest volume of high specific gravity wood in its outer layers (2.56 cubic feet with a specific gravity of 0.50 or more as against 1.79 cubic feet for the codominant tree and 1.32 cubic feet for the intermediate tree). Samples taken from the outer growth rings, therefore, will not differ greatly in specific gravity. Similarly, radial section samples (Figure 1B) will show less variation in specific gravity between crown classes than will linear samples (Figure 1A) which emphasize the low density central core out of proportion to its contribution to tree volume.

Site.—The effect of site quality on specific gravity has interested scores of investigators over the past century (Trendelenburg, 1939). For example, both Lassila (1931) and Kalnins (1930) found that Scotch pine on the *Calluna* (heath) type had a higher specific gravity than the same species on the *Myrtillus* type; while the specific gravity was lowest on the moister *Oxalis-Myrtillus* type. The variation in specific gravity of European conifers according to geographical location has also been studied extensively.

In North America, several studies have failed to demonstrate any strong relationship between specific gravity and site quality (Harlow, 1927; Luxford and Markwardt, 1932; Hale and Prince, 1936; Anderson, 1950). Unfortunately, the value of several site studies is limited by failure to segregate the known effects of age on specific gravity from the possible effects of site quality. Very few of these studies present any statistical evaluation of their data.

For marked variation of site quality, substantial differences in density have been noted. Paul (1927, 1930) has pointed out that shortleaf pine (60-70 years old) growing on light gravelly sand has a markedly lower specific gravity than the same tree on red clay loam. In a later paper, Paul (1946) states that mountain Douglas-fir has a lower specific gravity than Pacific Coast region wood of the same species, and that jack pine on an extremely dry site in the Nebraska sandhills was very low in percent summerwood and in specific gravity. In a recent paper, Paul (1950) found that slower-grown Douglas-fir on Site IV had higher specific gravities than comparable faster-grown wood from Site II. Many of these site effects can be attributed to local conditions for summerwood production. On sites where growth ceases before much summerwood is laid down, specific gravity is apt to be low. Irrigation of dry sites (Paul and Smith, 1950) and draining of wet sites (Kalnins, 1930) are both known to increase summerwood production and specific gravity.

In a detailed study of 35-39-year-old jack pine stands on sandy glacial outwash in Wisconsin, Wilde, Paul and Mikola (1951) tested specific gravity on 5 distinct sites. Specific gravity was highest on the drier and less fertile sands (*Cladonia* and *Arctostaphylos-Ceanothus* types) and lowest on the better sites (*Gaultheria-Maianthemum* and *Vaccinium-Cornus-Rubus* types). On moss peat, specific gravity was very high near the ground and very low 25 feet above the ground.

In the present study, an attempt was made to segregate effects of site on specific gravity in two stands in Itasca State Park. Eight trees of various crown classes were sampled at each of several nearby topographic levels. In the 57-year-old stand east of Douglas Lodge, the sites sampled were (1) hill top, averaging 30 to 80 feet above nearby swamps; (2) high slope, (3) low slope, and (4) swamp periphery. In the 70-year-old stand along the north boundary, the sites sampled were (1) hill top, averaging 20 to 30 feet above nearby swamps; (2) mid-slope, and (3) swamp periphery. The site series was replicated four times in the first stand and twice in the second. In this way, it was hoped to obtain the maximum variation in soil moisture conditions within a single stand and a single (outwash sand) soil type. Increment borings for density determinations were taken at breast height.

Site index was found not to vary significantly between the two stands, but to vary between the different sites in the same stand. The greatest height growth was found in the mid-slope sites. Thus, the average height on high slopes was 64 feet for the 57-year-old stand (site index 59 at 50 years) and 71 feet for the 70-year-old stand (site index 58). The hill-top trees had a lower mean height and site index (61 feet and site index 56 for the younger stand; 66 feet and site index 54 for the older stand). Finally, trees growing along the margin of the spruce and tamarack bogs had the lowest mean height and site index (57 feet and site index 52 for the younger stand; 65 feet and site index 53 for the older stand).

Despite the differences in topographic site and in site index, no evidence whatsoever was found relating site class to specific gravity (Table 4). We may tentatively conclude, therefore, that while major differences in site quality undoubtedly influence specific gravity, the correlation between the two factors is not high, and the relationship frequently cannot be found even under carefully controlled experimental conditions.

Silvicultural Considerations

Bearing in mind the effect of position in tree and of growth rate on specific gravity, we may ask whether or not specific gravity can be influenced by silvicultural practices. The answer is a qualified yes.

Paul has repeatedly emphasized that specific gravity can be raised if the proportion of summerwood laid down can be increased. Thinning, pruning, and spacing control may be used to achieve this end. Thinning or other operations designed to stimulate the growth of individual trees, though, may have various effects. In southern pine, for example, release has under various conditions been shown sometimes to increase and sometimes to decrease specific gravity (Paul, 1930, 1941), or to have no

discernible effect (Bethel, 1947). In old-growth ponderosa pine released in 1895, Paul and Meagher (1949) reported that "considering the great acceleration of growth following release, the average specific gravity of the wood of more rapid growth differed comparatively little from the wood of slow growth formed earlier." Various papers detailing the effects of pruning, spacing, irrigation, and draining on specific gravity have been referenced earlier.

We may agree with Paul that specific gravity can be controlled by silviculture if the summerwood percent can be controlled. There seems to be very little evidence, however, that low-cost silvicultural treatments in general, or stand density controls in particular, have any great or highly significant effect on percent summerwood at a given position in the tree.

This brings us to the question as to whether or not silviculturists are justified in striving to grow wood having a uniform number of rings per inch from the center outward. Such a course has frequently been recommended. There are several valid objections to such a recommendation.

First, as has already been pointed out, the correlation between ring width and specific gravity for a given position in tree and age of ring is generally either low or non-existent. Even granting that ring width can be held constant, there is very little guarantee that specific gravity can be measurably increased by the procedure.

Second, successive annual rings of even width are not consistent with biological laws of growth, and cannot, therefore, be obtained except under extraordinarily careful manipulation of stand density and tree crown and root relationships. For the largest part of their period of active growth, trees tend to put on an equal cross-sectional area of wood each year. Since each successive ring is placed on a successively larger circumference, it follows that the width of ring naturally decreases from the center of the tree outward. This is the normal state of affairs and therefore the easiest and most economical growth pattern to maintain. The philosophy of suppressing the tree in youth and releasing it later is difficult of execution because suppression in youth invariably leads to at least partial suppression in later years (Craib, 1939, 1947). In other words, if the silviculturist keeps the early rings narrow, the later (and higher density) rings will be narrower than they otherwise would be. A fast-growing tree will produce a higher volume of high density wood in later life than a slow-growing tree despite the low density wood of its core. It is the volume of the specific gravity band and not the width of the band along the radius that is important in assessing lumber production. There is much justification for the arguments of Turnbull (1947) and others in South Africa that fast-growing plantations will produce more high specific gravity wood than slow-growing plantations, even though the mean specific gravity of the fast-growing trees may be lower because of the low density central cores.

Third, we must also remember that high specific gravity is not always synonymous with high values. Although the relationship between specific gravity of normal wood and strength properties is thoroughly established (Markwardt and Wilson, 1935 and many others), low specific gravity wood may be desirable for many purposes. To cite but one instance, low specific gravity wood has many advantages over comparable denser wood for pulping (see papers by Bray, Chidester, and Curran).

Fourth, high specific gravity per tree does not necessarily mean high production of dry wood matter per acre. In fact, the reverse is generally true. Slower-growing stands may have a higher mean specific gravity per tree, and at the same time a lower production of merchantable volume per acre than faster-growing stands. This has been demonstrated for longleaf pine by Bray and Paul (1930) and for jack pine by Wilde, Paul and Mikola (1951). Total wood production per acre by weight, therefore, may be highest for the faster-growing stands even though the mean specific gravity per tree is low.

Summary

The large number of papers written over the past century on the effect of growth conditions on specific gravity in conifers are in basic agreement when such factors as age and position in tree are taken into consideration.

For hard pines and other conifers which have more or less distinct bands of summerwood and which are characterized by low taper, specific gravity decreases markedly with height. For spruces and other softwood with more or less indistinct bands of summerwood and considerable taper, specific gravity may not change or may even increase with height.

For trees up to approximately 100 years old, specific gravity generally increases markedly from the pith outward at any given height. At greater ages, specific gravity may decrease with age. This relationship may be due to structural demands on the wood at a given position (i.e. at a given distance outward from the pith) or it may be due to age. Little evidence is available as to which factor is most important.

The variation in specific gravity with position in tree (including both height and distance from pith or age) is considerable and very highly significant. Both height of the sample and age of the wood sampled must be held constant in any valid effort to isolate the effects of growth rate on specific gravity. If wood samples from various heights and of various ages are grouped together, a gross correlation of low order will be obtained between ring width and specific gravity. This correlation, however, is largely due to position in tree rather than to differences in growth rate at a given height and for wood of a given age.

If position in the tree is held constant, there is little or no correlation between ring width and specific gravity. In fast-growing trees, a large amount of low density wood is laid on in youth; while in slow-growing trees, low density

wood is laid on in old age. For most of the life of the tree, however, there is little relationship between growth rate and specific gravity. While a fast-grown tree may have a lower average specific gravity than a slow-grown tree because of its useful low density wood, it will actually produce a greater volume of high density wood in later years.

Major differences in site may produce variation in specific gravity, a variation associated with summerwood production. Although few statistical evaluations are available, the various negative findings that have been published would seem to indicate that site quality is not highly correlated with specific gravity.

For jack pine at Lake Vadnais (near St. Paul) and Itasca State Park in Minnesota, studies of three stands, 38-, 57-, and 70-years-old, revealed that (1) height of wood above ground, and (2) age of wood at a given height both had a highly significant effect on specific gravity. On the other hand, no variation in specific gravity was attributable to (3) ring width at a given position, (4) stem diameter within a given stand age class, (5) crown class, or (6) topographic site class.

In general, it would appear that most of the variation in specific gravity in wood samples is due to position in tree, age at which wood is produced, and structural design of the stem. Growth rate, whether due to position of the tree in the stand or to site, may have an effect on specific gravity under certain conditions, but its effect normally is much less than those of the above factors when judged on a statistical basis.

There is very little evidence favoring the strict control of ring width in the silviculture of conifers. Trees of regulated growth may have higher specific gravities than would otherwise be obtained, but the improvement is largely conjectural, the silvicultural control is difficult, and economic values of the timber on a per acre basis may not be improved or may even be lessened.

In general, conifers should be grown at the fastest rate commensurable with good form, small knot size, natural pruning, and other established silvicultural considerations. Although such fast-growing conifers will put on a considerable volume of low density wood in youth, they will ordinarily produce a greater volume of high density wood in later years than comparable slow-grown timber. Such fast-grown timber should ordinarily produce greater merchantable volumes and greater values of timber per acre on shorter rotations than can be obtained by attempting to repress tree growth in youth with the hope of stimulating it later in life.

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Notes

Classification Schemes for Forestry

Classification schemes for books, pamphlets, and miscellaneous files have concerned American foresters since comparatively early times in our professional development. Expansion of educational and library facilities in forestry and forest products has occasioned enough inquiry on the subject of late to justify a brief review of the matter.

One of the first systems for forestry to appear in American classification literature was Ernest Bruncken's "Scheme of Classification for Books on Forestry," published in the *Library Journal* in 1908. This scheme is interesting because the author fits his subject-matter outline to the needs of a professional forestry collection, rather than to a collection for lay use. A majority of the American systems developed since Bruncken's have similar scope delineation. Deviations chiefly are in notation methods, arrangement, and subject emphasis.

S. B. Detwiler's classification for forestry is included in an article entitled "Teaching Students How to Conserve Energy," published in *Forestry Quarterly* in 1912. The same year saw the publication of Yale Forest School Bulletin 1, "Classification of Forestry Literature Prepared by the Faculty of the Yale Forest School," and acknowledging the advisory help of extra-Yale persons, among them Dr. B. E. Fernow. These two schemes are followed chronologically by the appearance in 1917 of C. F. Korstian's "Decimal Classification for Forestry Literature," designed to expand the Dewey Decimal forestry number 634.9. The JOURNAL OF FORESTRY published this scheme in April of that year. Comments on it in the February issue of 1918 show that foresters and librarians alike were interested in developing a practicable classification system. Heads were put together again, resulting in the report of a Sub-Committee of the Society's Committee on Forestry Education, entitled "An Outline for the Classification of Forestry Literature," by Messrs. Korstian, Recknagel, and Briscoe. The JOURNAL published this scheme, a numerical one with decimal expansion, in February, 1923.

This 1923 system of classification, for all its changes and adaptations throughout the years, remains the one forestry classification of American origin to obtain fairly widespread use. Its ancestors or descendants are to be found in forestry libraries at Yale, Syracuse, some of the experiment stations of the U. S. Forest Service, and in other institutions of the United States and Canada.

The problem of expanding the Dewey Decimal designation for forestry, 634.9, (which also is the designation used in the so-called Brussels or Universal system), received attention from foresters and documentalists other than Mr. Korstian. One of the best-known expansions of that time is the Flury system, named for Philipp Flury, whose "Bibliographie Forestière" was published in Switzerland in 1925. The Flury expansion experienced revisions and expansions of its own, and was adopted in several forestry documentation centers abroad, notably being used for a time in the Imperial Forestry Institute Library at Oxford.

Imperial Institute personnel have given thoughtful consideration to forestry classification for many years. About the same time that Flury's system appeared, the *Empire Forestry Journal* published R. S. Troup's "Classification and Referencing of Forest Literature," which employed a combination Roman numeral-alphabet notation. A year later, the International Institute of Agriculture in Rome published S. H. Howard's "A System of Filing Information on Forestry," which the author had developed in connection with silvicultural records kept in Dehra Dun.

Mention of these unrelated British schemes serves to introduce a culminating contribution to forestry classification, "The Oxford System of Decimal Classification of Forestry," issued in 1950 under the joint sponsorship of the International Union of Forest Research Organizations and FAO. The sponsors suggest its world-wide adoption. Foresters interested in examining the Oxford system (no one-minute task, for it is detailed and comprehensive) may obtain a copy through F. C. Ford Robertson, Director, Commonwealth Forestry Bureau, South Parks Road, Oxford. Reference copies are available for examination in some forestry libraries and documentation centers in this country.

Perhaps this discussion should note some other American classification schemes which include forestry within their broader frameworks. One of these is the U. S. Department of Agriculture's "Scheme of Classification"; another, the Library of Congress' "Class S: Agriculture." These are examples of schemes readily accessible to interested persons. Foresters also may want to hear about a recent development in American documentation which has yet, to my knowledge, to be applied in the field of forestry. Known as coordinate indexing, this system eliminates the need of a conventional classification scheme in the organization of information collections. A publication explaining this new system is given in the bibliography below.

It is certainly not the intention of this note to endorse the classification schemes listed to the exclusion of any not listed. Several systems known to me are omitted because of their narrow scope or limited accessibility. As for the schemes unknown to me, I am always glad to hear of them, no matter how humble or ingenious, and to pass the word along to inquirers at the U. S. Department of Agriculture Library.

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Is Host Condition the Cause of Insect Outbreaks?

A common belief is that vigorous plants or plants growing on good sites with adequate moisture are less susceptible to insect attack than unthrifty plants or plants growing on poor sites or on good sites without adequate moisture. Foresters and forest entomologists in particular (*1, 2, 3, 4*) have attempted to show that outbreaks are correlated with unthrifty trees such as those receiving insufficient moisture, growing on poor sites, or blown over by windstorms. The outbreaks are attributed to a weakening of tree "resistance" to beetle attacks, a weakening which permits the beetles to build up their numbers in such trees until the beetles reach outbreak proportions. It is true that some outbreaks can be correlated with unthrifty plants or with unfavorable conditions for plant growth. Many outbreaks occur, however, when plants are vigorous and when growing conditions are favorable, and outbreaks do not always occur when plants are unthrifty and when growing conditions are unfavorable.

It is believed that the answer to the cause of most outbreaks will be found in a change in the "quality of the organism making up the attacking population rather than in the condition of the host or its growing conditions. Viruses and bacteria are known to change in virulence. It is a reasonable assumption that the quality of other organisms changes likewise. This would permit one to make the following generalization, at least in respect to plants:

> It is not primarily the condition of the host but the quality of the casual agent that is responsible for an outbreak.

This generalization seems to hold whether the agent is an insect, nema, bacterium, fungus, or some other organism.

Losses will continue during an outbreak until one of three things or a combination of them takes place: (1) until a change occurs in the quality of the causal agent; (2) until the host is so reduced in numbers that the causal agent can no longer spread or multiply effectively; (3) until the casual agent succumbs to another causal agent. On this basis man may reduce losses by reducing the amount of host material or by reducing the numbers of the casual agent, but he will never be able to prevent outbreaks until he finds a way to prevent change in the attacking organisms. The development of so-called "resistant" varieties of plants may for the time being reduce losses, but sooner or later the "resistant" variety will become a preferred host. Painter (*5*) gives an excellent review of the work done to develop insect-"resistant" plants. As he frequently points out, many inconsistencies in "resistance" are reported. In this review insect populations appear to be regarded as static entities even when biotypes are mentioned. If insect populations are regarded as ever changing in quality, the apparent inconsistencies in respect to insect damage would cease to exist. There are numerous records of an insect population or part of it adjusting to a host not its usual one. Those that adjust will have progeny that prefer the new host. It is this writer's belief that rarely, if ever, is there true plant resistance to attack by organisms. An organism feeds on preferred hosts; if preferred hosts are not available it may attack other hosts. Since these plants are not the usual ones the organisms may not thrive. It may not multiply readily or it may not multiply at all; the attacks may be fewer or there may be no attacks. One might be tempted to say that the plants on which a group of organisms does not thrive are resistant in varying degrees, but it is doubtful whether this would be correct. It would appear rather that the quality of that particular group of organisms is such that the organisms have not been able to adjust themselves at that particular time to those particular plants.

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A 45-foot Tree Measuring Pole

Although a variety of tree measuring poles have been proposed these are suitable chiefly for trees less than 25 to 30 feet in height. The use of an Abney level or hypsometer in dense young stands above this height is frequently time-consuming and none too accurate because of limited visibility. These considerations led to construction[1] of a telescoping aluminum pole to be used by one man. The pole can be extended to 45 feet but its collapsed length is 13½ feet. It weighs 12½ pounds and is readily transported by use of a rack on top of a car.

Construction details are shown in Figures 1-4. Basically the pole consists of four lengths of standard 12-foot aluminum alloy tubing, *A*, *B*, *C*, *D*, (Fig. 1) of successively smaller outside diameters, from 1½ to ⅞ inches. The upper tube, *D*, fits snugly within *C* and is reversible. Although not used, a removable pin to lock *D* to *C* is suggested. *C* is centered within *B*, and *B* within *A* by means of collars and flanged caps of appropriate diameter, allowing space between the walls for a 1/16 inch braided aircraft cable to move freely.

The means of extension are illustrated in Figures 1 and 2. The slack master cable passes over a pulley on top of tube *A*, thence down within the tube and is fastened to the bottom of *B*. The secondary cable is secured at one end to the pulley block on *A* and passes over the pulley on tube *B* to the bottom of *C*. Thus pulling the slack master cable elevates *B*, and this in turn causes *C* to rise as the distance between pulley blocks of *A* and *B* increases. It is this coupled rise that gives the pole its effectiveness. When the pole is fully extended the master cable is passed through a slotted ring (8),[2] on *A* (Figures 2 and 4) where it is retained by a small cable clamp (7).

The necessary machine work is shown by a longitudinal section, Figure 2. Two plugs (1) protect the ends of the detachable pole *D*. Ring (2) acts as a stop when either end of *D* is inserted in *C*; ring (3) reinforces the top of pole *C* and supports ring (2) when *D* is in place. Ring (4), just below (3), provides clearance between the lower ends of *C* and *B* to avoid shearing the cable at this point when the pole is collapsed. The pulley block (5) (Figs. 2 and 3) at the top of *B* centers tube *C*. A notch cut in the side of *B* allows insertion of the pulley margin into the space between *B* and *C*, thus insuring free movement of the cable (a slot at this point might result in tube *B* crimping when the pulley block is attached). An elongate screw serves as a stop to prevent the pulley from striking the lower pulley block (6) when the pole is collapsed. Pulley block (6) is similar to (5) except for its larger dimensions and provision for fastening the secondary cable. The flanged base caps (9) and (10) center the lower ends of the tubes. Each cable is fastened to its respective cap about a chamfered screw after passing diagonally through the tube wall and cap, as shown in Figure 2. This method prevents the cap from striking the pulley margin at full extension and increases rigidity of the pole. Base cap (11) serves to exclude dirt. Several small cable clamps provide grips for pulling the cable and, as noted, the top clamp is caught below slotted ring (8). All other clamps, rings, etc., are attached with set screws. Tolerance allowed for free movement of parts is 1/64 inch.

Material costs were $20.85 for tubing, $6.00 for cable and $6.23 for stock, set screws, etc. Labor costs for the original, made in a university shop, were somewhat excessive. The present shop estimate of labor cost for subsequent poles in lots of three is not to exceed $60 each.

The pole is painted in foot-long bands, using a colour code to indicate height; thus red marks the 5 and 10 foot levels, blue the 2 and 7 foot levels, yellow the 3 and 8 foot levels, with the natural aluminum for the intervening spaces. When used by one man the pole is placed near the trunk and extended through the crown, above the tree top; with the pole thus supported the operator moves to a vantage point and reads height directly to ½ foot by reference to the color code.

Without support from the tree crown the extended pole ares appreciably although it can be handled by one man except in windy weather. Use of a stiffer alloy might increase rigidity. Tubing smaller than ¾ inch is too flexible for more than a short extension beyond *D*; heights above 50 feet, however, could be obtained by adding a larger diameter section to the base.

Small trees can be measured without full extension: Tube *D* can be used alone for trees up to 12 feet or, with *D* in place on the collapsed pole, trees up to 23 feet can be conveniently measured. Omitting (or reversing) *D* and extending *B* and *C* provides a 34 foot pole.

The pole in its present form has been tested through some five hundred measurements by one man in coniferous plantations ranging from 30 to 50 feet in height. In addition to its accuracy, use of the pole in closed stands required but one-third or less of the time needed with an Abney level and tape. It is estimated that most of the construction cost was offset by saving in labor costs during a single summer's use.

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[1] J. J. Fitzgerald, supervising mechanician of the Physics Department Shop, was responsible for much of the engineering detail.

[2] Numbers in parenthesis refer to the indicated components of the diagrams in Figures 1-4.

ity of the organism making up the prevent change in the attacking *Alexandria, Va.*

Partial Bill of Materials

4-12 foot round drawn aluminum tubes, 24 S-T 3:

⅞" O.D.—.049" wall

1" O.D.—.049" wall

1¼" O.D.—.049" wall

1½" O.D.—.065" wall

30 feet, 1/16" 7x7 braided stainless steel cable

6 lbs. (approx.) round and flat dural aluminum stock

Set screws, cable clamps, etc.

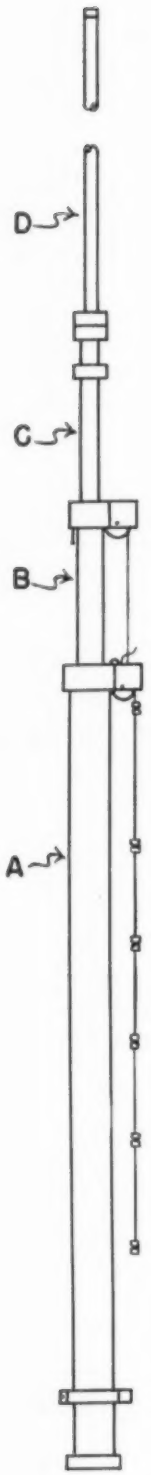

FIG. 1

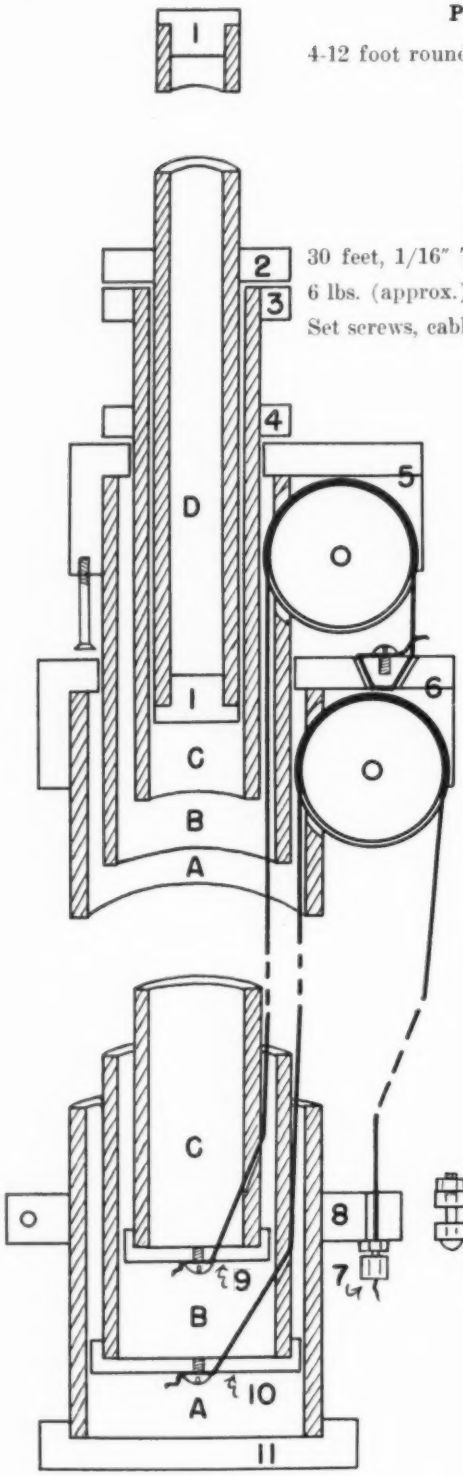

FIG. 2

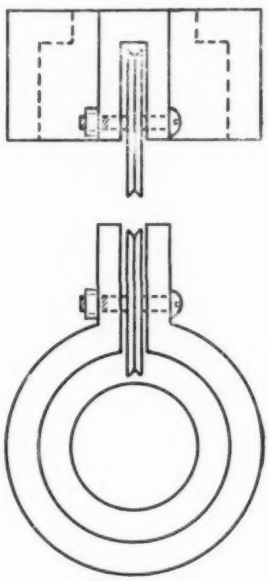

FIG. 3

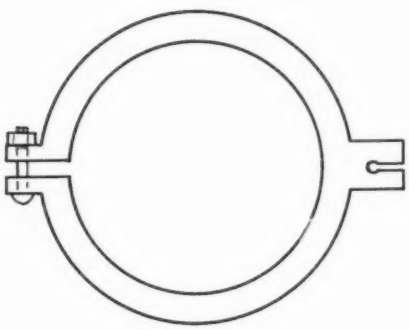

FIG. 4

FIG. 1.—Exterior view with pole partly extended (not to scale). FIG. 2.—Longitudinal section showing detail. FIG. 3.—End and bottom views of pulley block (5). FIG. 4.—Bottom view of slotted ring (8).

Secretary of Agriculture Approves Modification of Regulation S-15, Adopting International Decimal ¼-Inch Log Rule for Forest Service Use

For the past few years, the International ¼-Inch Log Rule has been used to a considerable extent by the Forest Service for scaling logs on the national forests in the Eastern Region. During the same period the Scribner Decimal C Rule has also been used. As a result of considerable experience with the two rules, it has been found that, for the timber in the Eastern Region, the International ¼-Inch Rule gives volumes that are more equitable to both the buyer and the seller than the Scribner Decimal C Rule.

The original International ¼-Inch Rule is the rule published by H. H. Chapman from figures prepared by Judson Clark[1]. For some time, field men have seen advantages and savings in time in the use of a decimalized rule. In the course of many readings, many entries in scale books, preparation of cutting reports, audits, etc., the saving of the extra figures amounts to considerable in the course of a year's work for many men. Experimental trials of the decimalized rule computed to the nearest 10 board feet from the basic formula, as given by Bruce and Schumacher by 1 inch diameters from 6 to 30 inches and by two foot intervals of length from 8 to 16 feet, give results close to those obtained from the original rule.[2]

The Secretary of Agriculture has approved an amendment to Regulation S-15, which authorizes the use of the Decimal ¼-Inch Log Rule for scaling national forest timber. The amended regulation was published in the Federal Register November 13, 1953 (36 CFR 221.15). The International Decimal ¼-Inch Log Rule may now be used for scaling timber on the national forests, if such use is specified in the advertisement and in the contract or permit.

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[1]Chapman, Herman H. Forest mensuration. John Wiley and Sons, Inc. Par. 60, p. 64. 1921.

[2]Bruce and Schumacher. Forest Mensuration. McGraw-Hill. Par. 112, p. 164. 1942.

TABLE 1.—INTERNATIONAL DECIMAL ¼-INCH LOG RULE

D.i.b. (inches)	Length in feet: 8	10	12	14	16
	Board foot volume in tens				
6	1	1	1	2	2
7	1	2	2	2	3
8	2	2	3	3	4
9	2	3	4	4	5
10	3	4	5	6	6
11	4	5	6	7	8
12	4	6	7	8	10
13	5	7	8	10	12
14	6	8	10	12	14
15	7	9	11	14	16
16	8	11	13	16	18
17	10	12	15	18	21
18	11	14	17	20	23
19	12	16	19	22	26
20	14	17	21	25	29
21	15	19	23	28	32
22	17	21	26	31	35
23	19	24	28	34	39
24	20	26	31	37	42
25	22	28	34	40	46
26	24	30	37	43	50
27	26	33	40	47	54
28	28	36	43	51	58
29	30	38	46	55	63
30	33	41	50	59	67

Computed from: Volume of 4 foot section for ¼" sawkerf = $0.22D^2 - 0.71D$ and on assumed taper of ½ inch in 4 feet. Result multiplied by 0.905 to convert to ¼" sawkerf.

Mail Surveys in Forestry Research

The mail questionnaire is a tool used in many fields for collecting information from large numbers of scattered people. What potentialities do such surveys have in forestry research? Some idea of their effectiveness and the problems involved in their own use may be obtained from our experience with three mail surveys. These consisted of questionnaires on: (a) pine stumpage and log prices sent in 1950 to 1,441 sawmill operators in North Carolina, (b) costs of planting, thinning, and other forestry operations sent in 1952 to 245 foresters throughout the South, and (c) annual use of fence posts sent in 1953 to 411 farm operators in Jasper County, Georgia.

It is characteristic of mail surveys that the mailing lists are seldom completely accurate or up-to-date. In both the price and post surveys, the post office returned six percent of the letters as not deliverable. In the cost survey two percent of the letters were returned even though the list was made up just before mailing.

The first response to a mail survey is almost certain to be disappointing to a new user. We received the following percent responses to the letters sent in our original mailings:

Price survey	15
Cost survey	40
Post survey	20

Three factors favored a higher response to the cost questionnaire: salutations and signatures were added indivdually to the form letters giving a personal touch, the recipients were foresters and presumably interested in the information sought, and many of them were personally acquainted with the writer or were alumni of the Georgia School of Forestry It appears that even under favorable conditions only about a one-third response can be expected from the first mailing.

There probably are many reasons why people do not return mail

questionnaires. Apparently some feel their replies are not important to the survey: others just procrastinate. Many of those who do not reply for reasons such as these, will answer a follow-up letter. Ten days after the original mailing in the price and post surveys the same letter was sent again to those who had not replied, this time plainly marked "Second Request". A third mailing of price questionnaires was made at the end of another ten day interval, the letters being marked "An Immediate Reply is Requested". For the third mailing in the post survey a new letter was written stressing the need for information from those who had disregarded the first two letters. The effect of these follow-up mailings was striking. The percent response to the different mailings by those who apparently received their letters was as follows:

Requests	Price survey	Post survey
First	16	21
Second	24	21
Third	9	13
Total	49	55

The amount of data obtained from a mail survey evidently can be more than doubled by follow-up mailings. This is borne out by the fact that many foresters who did not reply to the cost survey have since indicated that they just never go around to sending in the questionnaire.

Doubling the amount of data obtained by use of follow-up mailings does not double the cost of the survey. Certain costs, such as obtaining the mailing list and preparing the questionnaire, are fixed for the survey regardless of the number of mailings. The actual cost (marginal cost) of the additional data produced by the follow-up consists only of stationery, postage, and stenographic services for addressing. It is our experience that even these variable costs average less for the second and third mailings than for the first. The numbers of letters mailed per reply in our surveys were as follows:

Mailing	Price survey	Post survey
First	6.8	5.1
Second	3.6	3.8
Third	6.5	4.4

However, the marginal cost of the additional replies would increase quite rapidly if further mailings beyond the third were tried.

It is important to note that the number of replies received is not a true measure of the amount of information obtained. In the cost survey, only 88 percent of the replies included the questionnaire: the others reported that they did not have the information requested. In the price survey, only 29 percent of the respondents were able to report prices. Since the post questionnaire merely asked for number of posts used, including "none," all of the replies received were usable.

The greatest fault of mail surveys is that a 100-percent response is seldom obtained, and the replies cannot be considered a random sample of the population. Acceptance of partial returns as representative may lead to quite erroneous results. Experiments show that the reasons why individuals are quick or slow to respond to a particular questionnaire are likely to be related to its subject matter. For instance, where quantities of an item are the information called for, the individuals with the largest quantities to report are usually the first to do so. This kind of bias can often be detected by comparing the means from several mailings. Our fence post figures are an example. The average numbers of posts used per farm from the three mailings were as follows:

First mailing	235
Second mailing	179
Third mailing	108

In this case there was a clear correlation between the number of posts used and promptness to respond. Consequently, it seems safe to assume that the average use by the non-respondents was still different from that of any of the groups who reported.

Whenever there appears to be a likelihood of serious bias, some adjustment of the data for non-response must be attempted. Houseman has suggested that such an adjustment should be considered unless at least a 90 percent response is obtained.[1] One method of adjusting is to interview a sample of those who did not reply to the mail survey. This is probably the most accurate method, particularly when the response to the mailings is weak. However, when data from three or more successive mailings are available, a method developed by Hendricks may provide a satisfactory adjustment.[2] For the fence post survey, Hendricks' method gave an estimated population mean of 126 posts.

We feel that the mail survey has a definite place in forestry research, provided it is well planned and repeated mailings are used to overcome the natural resistance to returning questionnaires received by mail, and to detect and minimize bias.

[1]Houseman, E. E. Statistical treatment of the non response problem. Agricultural Economics Research, Vol. V, No. 1. 1953.

[2]Hendricks, W. A. Methods of obtaining information and of estimating in *The Agricultural Estimating and Reporting Services of the U.S.D.A.*, Misc. Pub. 703, 1949.

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Points of View

Comments on "Research in the Economics of Forestry"

I have been hoping that someone would criticize the book *Research in the Economics of Forestry*,[1] edited by Professors Duerr and Vaux, published by the Charles Lathrop Pack Forestry Foundation, and sponsored by the Society of American Foresters, somewhat more severely than any comments I have seen. This is a large and important book, which is bound to be used as a textbook by the large numbers of students mentioned in the foreword. They are named as research workers . . . research institutions . . . graduate students, etc.

Great authority will be imputed to this work over a long term of years, so that it will shape forestry thinking to a large extent. With all of its undoubted merits, I fear that there have been some grave omissions and that, in some of the most important matters which have to do with the economics of forestry, the book will prove misleading and actually dangerous. The acceptance without question of taxation principles which are monstrously unjust, and the use of some material which is extraneous, will add to confusion rather than clarifying the subject.

A few pages, 242 to 254, are devoted to the financial problems of forest management. This is absurdly little out of 475 pages. Surely this is a very important part of the subject. These 13 pages deal, sufficiently well, with forest fire insurance, the effects of income and death taxes on forest management, and the assessment of forest properties. The latter two of these are fundamental.

Although we have accepted the heavy graduated income tax, and death duties which go part way toward the destruction of inheritance rights, they are and must remain unjust levies on wealth, not truly to be regarded as taxes at all. I think that this side of the matter should have been pointed out, regardless of the supposedly insuperable difficulties of returning to more just methods of taxation. I am one of the old-fashioned students who believe that every recommendation of Karl Marx should be suspect. He recommended a heavy graduated income tax, and the abolition of the rights of inheritance. His objective was the destruction of capitalism in the most advanced countries.

I believe it should have been stated that income taxes, death duties, and the wrong taxation of forest crops along with the land on which they are grown, are particularly detrimental to forestry. The assessment of forest land, as described, undoubtedly contemplates that the land and the growing crop shall be lumped together in assessment, and it is but a short and natural step to proceed to tax them both. Only the very best of forest land, an extremely small proportion of the total, can possibly stand such taxation. In order to achieve the widest use of forest land of lesser capacity, for the growing of timber, the land and the crop must be considered quite apart from each other. The imposition of a tax on land, in the form of an annual rental for its use, is common justice. A forest crop, on the other hand, is the capital which man has invested in order to use the land. It is in this respect analogous to the farmer's herd of cattle, which is not capable of bearing an annual tax on its value. If such a tax is imposed, it is an unjust levy, a penalty on the best and most efficient producer.

The book ignores altogether the teachings of Professor Filibert Roth at Ann Arbor; and his book, "Forest Valuation," which he published in 1916. Prof. Roth used the term Single Tax in his statement that this system was well-adapted to forests in giving his reasons. He took the trouble to correct the theory of some single-taxers, who proposed that the crop also should be taxed under that system. The term Single Tax is a misnomer, but one sees that error quite frequently even today. However, perhaps that is a detail. What Roth had in mind was the collection, by the state, of the full site-value of land, which is of course determined by its excess productivity as compared with the productivity of the least productive land in use at the time, this being the land at the margin of production, which can yield the full payments to labor and capital employed on it, but which earns no rent. Under this system land would never have any real selling-value; but it would have the maximum use-value, and make its utmost contribution to the economy of the country. The owner would own everything which, by the application of labor and capital, he could produce from it. While the bare land value would be practically nil, his growing stock would come to have an immense value. I see no possibility of the maximum and best use of forest land under any other system of taxation.

No book, which pretends to be comprehensive, dealing with the economics of forestry, can ignore this line of thinking. Foresters who ignore it are turning their backs on one of the world's most important problems, which is how, with rapidly increasing populations, the land resources may be used justly as between all citizens, those who own land, and those who do not.

A less important matter is the introduction of the terms entrepreneur and entrepreneurship, and then using them in a meaning which is completely new.

The term entrepreneur appears much less commonly among students of political economy today than formerly, although it had, and still should have, wherever it is used, a well-recognized meaning. The science of political economy is simpler to understand, and its conclusions are more accurate and clear-cut, if

[1]Reviewed in Jour. Forestry 51:584. 1953.

the agencies in the production of wealth are limited to three only, which are, of course, land, labor, and capital.

In the old meaning of the word, the term entrepreneur did not include the ownership of land. If there is the ownership of land, it introduces the land-owner, something quite different from the entrepreneur. The one person might of course exercise both functions; they should be kept entirely separate in any study of economics.

Labor, if defined as it should be, is human energy, however much physical, however much mental, exerted in producing wealth. This includes the managerial and other functions of the entrepreneur, which is why the term was dropped.

A land-owner who also "decides how capital and labor will be applied to resources, in this case forest land, and how resources will be used in satisfying demands," is exercising two quite different aspects—he is a land-owner, and a part of the labor force. It makes no difference whether the land-owner is a private person, a corporation, or the government.

The subject of forest taxation has been neglected by almost all foresters, and the proper method has nowhere been applied. It is far too important a subject to neglect, and it is a most serious omission in a book such as this one that no program for a proper study of it should have been outlined or suggested; nor any mention made of one proposal, that made by Professor Roth, which may have merit.

J. D. GILMOUR
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Reviews

The High Trail

By Elers Koch. 179 pp. Illus. The Caxton Printers, Ltd., Caldwell, Idaho. 1953. $3.50.

This novel takes its name from the old Nez Perce trail which crosses the Clearwater wilderness area in Idaho to the buffalo country on the Montana prairie. Two young men, Bill and Red, reared in central Idaho, are the joint heroes of the story. With old-timer John Bradford, as packer and guide, they undertake a hunting-exploring trip to the heart of the wilderness in September, 1890.

Leading the pack string, Bradford with the mules and one horse, plunge over a cliff in a tragic trail accident. Everything is irretrievably lost in the river, and Bradford is seriously injured. It is too far to pack him out. Furthermore, the trail will snow shut in a few weeks, so they realize they are thrown upon their own resources for survival with only some odds and ends of materials. The story is concerned mainly with how these two young men meet the situation.

There is more than a flavor of Robinson Crusoe in the story. Like that novel this one is also somewhat didactic, but principally it is pure adventure to be read for relaxation. The book would make a nice personal gift, award, or library acquisition.

Although experienced outdoorsmen might debate some of the decisions of the young men, journeymen woodsmen will discover much that is instructive about living comfortably in the wilds without store-bought conveniences. A stone cabin is constructed, heavy timbers raised for the roof, the lintel problem of the 4-foot fireplace solved. Clay pottery is thrown for utensils, bow and arrow armament fashioned, fish and meat cured, skins tanned, and even a blacksmith forge is devised for refashioning horseshoes and other pieces of metal into useful articles.

Much of the realism in the narrative distills over from autobiographical details blended into the story by the author. The behavior of the trail animals and countless other acute descriptions speak of the writer's familiarity with his subject.

For tingling adventure it is hard to beat Red and Bill's exploring sortie down the river. A snow bridge collapsed under Red, and the swift current swept him under the ice. On another reconnaissance, Bill plunged through an overhanging cornice of snow above a glacial cirque and was buried in the avalanching snow. Again, there is a terrific wolf fight—man against famished beast. A mysterious wild man is included for good measure.

Foresters count few novelists among their ranks and can well be proud of this first attempt at fiction by Elers Koch. He was born in Bozeman, in 1880, the son of a Montana pioneer. Graduating in forestry from Yale in 1903, he entered the Forest Service under Gifford Pinchot. All his career was spent in the West. He retired from the Forest Service in 1943 and now resides in Missoula, Montana. (See "We Present," JOURNAL OF FORESTRY, Feb., 1949.)

The book is remarkable for its high quality of manufacture. The numerous and uniformly excellent illustrations are by L. D. Cram of Martin, Georgia. His exceptionally graphic and realistic treatment of wild and domestic animals vividly accents the story. Pictures in the text are pen and ink drawings, reproduced letterpress from zinc line etchings. Frontispiece and jacket are both reproduced by lithography four color process from originals done in full oil. The illustrations, readable Garamond type, rather heavy distinctive paper, and handsome, silver-stamped red case all combine to raise it above the usual editions of western novels.

BEN M. HUEY

Public Administration of Florida's Natural Resources

By Hubert Marshall and Robert J. Young. Public Administration Clearing Service, University of Florida, Gainesville. 1953.

The publication reviews Florida's administration of its natural resources from the beginning of statehood to the present. It has chapters on lands, water, forests, wildlife, minerals, and recreational resources showing how the administration of each resource has developed and how it is handled at the present time. The report further describes the various organizations now handling the natural resources from the standpoint of fiscal and personnel control as well as their planning, research and publicity activities and inter-agency relationships.

It is shown that in Florida, though richly endowed with natural resources, "a large part of the more than 20 million acres of federal lands deeded to the state was recklessly given to railroads or sold for a pittance to land companies whose sole interest was speculation." Although many laws providing for conservation of natural resources were passed in the early days, there was little or no enforcement until after 1900. In this respect Florida followed closely the pattern of other public land states in the reckless dissipation of its natural resources. Few really constructive programs were inaugurated until the past few decades and even then efforts have been sporadic and enforcement lax. The whole state administration of these resources seems to have grown "like Topsy." When conditions of any resource became critical, the state seems to have set up new organizations and new boards or commissions. Only rarely has an attempt been made to coordinate the administration of the various resources and those made have not often been successful.

The authors show that at present "14 separate agencies are charged with administering Florida's natural resource programs. Despite this large number, there is substantial uniformity in their basis organizational structure. All but one operate under the direction of a Board or Commission. Four of the agencies are supervised by the state cabinet which consists of independently elected officials who cannot be controlled or held accountable by the state's Chief executive. Nine of the agencies are supervised by Boards or Commissions, the members of which are appointed by the Governor for overlapping terms and cannot be removed from office without the consent of the Senate."

In conclusion the authors appraise the present administration of each resource and give some pointed recommendations for improvement. They then point out that closer cooperation and coordination between the various agencies with pooling of some activities would lead to economy and efficiency. But in the end they conclude that the real solution of the problem lies in the establishment of a department of natural resources and a merit system for all employees in the natural resource agencies.

The authors delved deeply in developing their subject and acquired real familiarity with these state agencies. The descriptions and analyses of the administration are to the point. The conclusions are logical and well presented, and all in all it is an excellent report. It should prove of interest as a chapter in the development of state management of natural resources in the United States. It should be more valuable, however, to those citizens of Florida who are interested in the state's natural resources and what has happened to them. Finally, it will be of greatest value as source material for those who are interested in improving the administration of Florida's natural resource management on a coordinated, efficient, and economical basis.

The authors should feel satisfied that they have done a real service in bringing together in one place a detailed account and an analysis of the administration of Florida's natural resources with splendid recommendations for improvement in their management.

JOSEPH C. KIRCHER

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Elements of Forest Economics

By Sven Petrini. Translated by Mark L. Anderson. 210 pp. Oliver & Boyd Ltd., Edinburgh, Scotland. 1953. 22s. 6d.

American readers who are not familiar with the European tradition in "forest economics" may well be surprised at the narrowness of the field delimited in this book. The discussion is largely devoted to a single aspect of the economics of forestry, that of comparative forest valuation. Academic coverage of this material in the United States is more likely to be found in a course in forest economics.

Sven Petrini, professor in the Swedish Royal School of Forestry, has long been known for his original contributions to the theory of forest valuation. In this book he brings together European experience in this important field, subjects it to careful analysis, and presents a coherent framework of theory and practice in forest valuation. English speaking foresters owe Prof. Anderson a debt of gratitude for making this definitive European work available in lucid translation.

The book is divided into two parts. In the first part Prof. Petrini develops his general theory of forest valuation. The discussion covers topics such as the principle of interest payments, the determination of productivity, the calculation of the forest soil-value, and calculations respecting the normal forest. In the second part this theoretical structure is brought to bear on a number of practical problems, including the determination of the rotation, the economics of thinning, the economics of regeneration, and valuation for special purposes.

American forest economists will warmly endorse Prof. Petrini's plea for physical productivity data which can provide an adequate basis for economic calculations. It is interesting to note that he greatly prefers the use of increment percent to the "less handy" absolute measures. It should be emphasized that the procedures advocated here are set in terms of a large amount of experimental data expressed in percentage terms, a condition which simply does not exist in American practice.

Attention should also be called to Prof. Petrini's discussion of the normal forest concept. By squarely facing the inadequacies of the traditional concept for handling such major problems as intermediate cuttings in even-aged management and the entire field of selection management, he contributes substantially to a realistic and useful concept of the normal forest.

Particular emphasis is given to an analysis of Faustmann's well-known formula for calculating soil value. The argument is advanced that this formula contains a theoretical error, in that it assumes that overhead costs are uniformly distributed over time. Prof. Petrini claims that actually such costs are heaviest toward the close of the rotation. Allowance for such a time distribution of costs, of course, tends to increase the calculated soil value.

Here, as at other points, it seems to the reviewer that a more rigorous definition of overhead costs would contribute greatly to the discussion. In this connection, it might also be mentioned that it is surprising and somewhat disturbing to find that nowhere in this book on value theory in forestry is use made of the familiar terms of economics such as average cost, marginal cost, variable cost, or fixed cost.

Comprehensive though the book is in its special field, it still will provide little assistance to American foresters in solving some of their more troublesome and urgent problems in valuation. The chapter on stumpage-value is based on the usual residual approach of subtracting costs from product selling

price, but wholly ignores the critical issue of the division of this remainder between stumpage and profits. Similarly, the summary dismissal of the question of risk with the statement that "the risk premium must be assumed to be out of the question when dealing with such long periods" seems more a matter of avoiding rather than of answering a complex question.

In general, it is the reviewer's impression that the questions at issue in this book are not those which pertain the most directly to the present stage of American forestry. Thus it seems probable that the book will have only a limited audience in the United States, consisting mainly of academicians and others interested in the refinements of a mathematical approach to comparative forest valuation. For this special group, however, the book will provide stimulating reading.

JOHN A. ZIVNUSKA

Elements of Forest Fire Control

FAO Forestry and Forest Products Studies, No. 5. 110 pp. Illus. Columbia University Press, New York 27. 1953. $1.

This publication, dated March, 1953, is the latest of a series being prepared by FAO in furtherance of its forestry program. Its purpose is to assist countries to plan and organize protection against forest fire wherever better protection is needed. It is timely and should make a distinctive contribution to that program. Its timeliness, as pointed out in the introduction, arises from the fact that any country undertaking to develop a conservation and forestry program must first of all eliminate or reduce the threat of fire and other destructive agents to a point where they will not disrupt plans for timber production or other wildland use. Otherwise, such plans may have little meaning.

It should be a distinctive contribution to the program since no similar publication exists and no parallel publications have been prepared by workers in the countries where protection from fire has become highly organized. Its scope is broad and includes considerations beginning with national policy and carrying through to correct practices in fire control.

Very properly, since it is addressed to the policy makers and planners, techniques of accomplishment of the various objectives set up have been for the most part omitted. For that reason, a new student of the subject will need to go much further than the publication itself to attain a full grasp of the task. The special virtues of the publication are the degree to which it distills knowledge gained from experience and the manner in which all the inter-relationships in successful protection from fire are clearly set forth. This, no doubt, reflects the contribution of S. B. Show, who was long regarded as one of the leading contributors to policies, principles and methods of systematic forest fire control in the U. S.

It is disappointing that the chapter devoted to fire suppression does not give a clearer picture of how a forest fire is fought, nor of the kinds of fire behavior that dictate variations in the methods employed. Without some background in this respect the reader will find it difficult to grasp the full significance of the eight brief captions under "Correct Practices" of this chapter, and may not fully appreciate the importance of training as a prerequisite to successful operation of any system of protection.

Similarly, the chapter on prevention, though adequate in discussing methods that can be used, does not point out the importance of understanding the people who reside in forest areas and who must be dealt with in preventing fires. Where use of fire destructive to forest values has become established as a part of their habitual pattern of activities, great skill may be required to eliminate fire setting, including the elimination of economic motives.

Throughout the publication minor errors in print occur, which were not picked up in proofreading, and in one or two cases statements are made which, at least from the American viewpoint, are somewhat garbled. However, these are not sufficient to detract from the value of the publication for its intended purpose.

Historically, great destructive fires have usually accompanied extensive exploitation of forest resources in undeveloped countries. If, in even a single country, this consequence can be averted or ameliorated through advance analysis of the situation and proper planning along the lines suggested in this publication, its preparation will have paid off handsomely. It is to be hoped that FAO will continue its effort to improve the success of forest fire control in member countries through further amplification of this publication and further supplemental measures.

A. A. BROWN

Histories of Activities in the Field of Natural Resources, University of Michigan

Samuel T. Dana, editor. 353 pp. Illus. Univ. of Michigan Press, Ann Arbor. 1953. $3.

Published in connection with the celebration, October 1-3, 1953, of the semicentennial of professional forestry instruction at the University of Michigan, this volume is appropriately dedicated to the late Filibert (Daddy) Roth.

It is interesting to note that a course in forestry was offered at the university as early as 1881. Since that year the institution has earned for itself an honored and essential place in all phases of education having to do with natural resources. Over the years its faculty has comprised a *corps d'elite* in forestry education, and its alumni have made notable contributions to forestry research and applied practice.

In truth, the University of Michigan has exercised a significant influence on the course of American forestry. (That the influence has been a good one goes without saying.) With but few exceptions the faculty members of the School of Forestry and Conservation (since 1950 the School of Natural Re-

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sources), have been active in professional and scientific affairs, off the campus as well as on.

As a case in point, the Society of American Foresters has benefitted greatly over the years through the contributions made by faculty members to the Journal of Forestry, to the Council of the Society, and to the Committees, Sections, and Divisions. The alumni of the institution have been no less diligent. Thus, although the university's first obligation as a publicly supported institution has been to serve the state, it has effectively served the nation, science, and the forestry profession as well.

About one-half the book is devoted to a history of forestry and related education at the university. The growth of the several curriculums in response to changing demands for men with technical specializations is told at length and most interestingly. Approximately the second half of the book is devoted to brief biographical sketches of the careers of individual alumni in public service, business and industry, research, education, and in work abroad.

An historical and useful reference work, this volume is in itself a landmark in the literature of forestry.

The Journal of Forestry salutes the School of Natural Resources on its entry into its second half-century of service.

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Lookout Wife

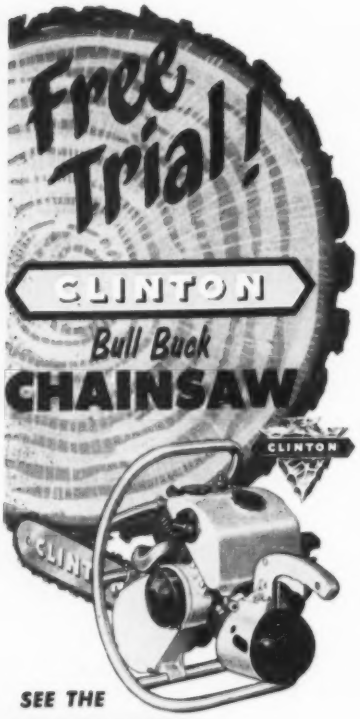
By Jeanne Kellar Beaty. 311 pp. Random House, Inc., New York 22, N. Y. 1953. $3.50.

Two young college newlyweds spent several summers perched in a fire lookout tower on the Salmon National Forest in Idaho, overlooking a wilderness of pines and firs. Out of this experience, which must have been meticulously logged from day to day, evolved the book *Lookout Wife* by Jeanne Kellar Beaty.

The Beatys were prompted to take the post of smoke spotter by an eagerness for a way of living totally different from that of big city life. Some people satisfy their escape urges by seeking south sea islands. With much less expense and effort, moreover with a useful purpose, these youngsters chose a wilderness area of the United States for their adventure in primitive living.

Their life in a lookout tower proved satisfying from an aesthetic standpoint, if not a financial one, and it certainly was rich in human values, and educational in the ways of the Forest Service in fighting forest fires in the western mountains. This book is an accurate, if at times a somewhat over-detailed, account of how the job was acquired through the Louisiana State University Forestry School, and the tenderfoot's initiation into the ways of the West and the federal government.

For two summers Jeanne and her husband, Chip, made their home in a fourteen-foot square glass-sided



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cabin on top of a mountain peak overlooking a vast panorama of some of the most remote country in the North American continent. It was complete with ultra-modern telephone and radio communications, an ultra-primitive one-hole outhouse, and a spring water source a good half mile from the cabin.

Their job as lookouts consisted of scanning the horizon at frequent intervals for smoke, generally following a lightning strike, which spelled forest fire. The fire location then had to be spotted on a map and telephoned or radioed to fire headquarters, from whence manpower and on occasion machines were dispatched. Often "smokejumpers" were used on such missions, ferried to a position near the fire and then dropped in parachutes. Separate chutes carried items of equipment and food. The author pays a tribute to the know-how and *esprit de corps* of the fire fighting teams and captures the tension and drama of situations leading to a blowup of a fire.

In spite of the ruggedness of the existence the writer found time to admire the majestic timber clad mountain ranges, the pristine waterfalls, rivers and lakes; the infinite variety of the sunsets; the overwhelming power of natural phenomena like thunder and wind storms; and the habits and antics of the wildlife from chipmunks to elk. These had to serve as substitutes for TV, pub crawling, bridge-luncheon yak-yak, and Saturday night movies offered by urban life, and were not found to be wanting.

Lookout Wife is an unusually painstaking recording of a plethora of detail, some of it highly technical, and certainly beyond the scope of woman's usual experience. It would be old stuff to most foresters, but the book would be a good gift for one of their big city relatives who may yearn for an adventure in primitive living without sacrificing the comforts of his own hearth. I presume the Forest Service will present, well in advance, complimentary copies of this book to all prospective lookouts who expect to bring a wife to their station!

HAZEL STOICK STOECKELER

★ ★ ★

THE DOUGLAS-FIR INDUSTRY employs more than 750 professional foresters. 275 of these are managing tree farms.

★ ★ ★

Publications of Interest

The full proceedings of the National Chamber of Commerce meeting in San Francisco, Sept. 30, 1953, on the subject of federal lands, has been published under the title, *The Proceedings of the Western Chamber's Conference on Federal Lands.*

Among the subjects discussed were grazing policies, abuses of mining claims on federal lands, and government timber sales. Limited copies are available at $1 each, from the Natural Resources Dept., Chamber of Commerce of the United States, Washington 6, D. C.

• • •

West Coast Tree Farms—Growing Trees For You is the title of a full-color, 8-page, booklet released by the Industrial Forestry Association and intended for general distribution. It tells in brief form, with very excellent color photographs, the story of products from the woods to the living room, with emphasis on the work of tree farmers. It may be obtained from the association at 1410 S. W. Morrison, Portland 5, Oregon.

• • •

For the fifth successive year, International Paper Company is bringing the story of tree farming to the attention of school children and teachers in southern states. The comic book, *How Does the Tree Crop Grow*, for the youngsters, tells the story in digestible and interesting form, and the booklet, *Suggestions for Teachers*, provides teaching aids. The material is distributed by the Southern Kraft Division, Mobile 9, Ala.

• • •

Lodgepole Pine Bibliography will be a useful publication for foresters concerned with that species. It is Research Paper No. 30 of the Intermountain Forest and Range Expt. Sta., Ogden, Utah. (Forest Service, U. S. Dept. Agric.) The listing includes all the important references readily available to U. S. and Canadian foresters, some foreign literature, and many unpublished writings. A subject matter index at the end is most helpful.

• • •

Proceedings of the *National Farm Woodlot Conference*, held at Chicago June 1953 under the sponsorship of American Forest Products Industries, Inc., are available from that organization. Address: 1816 N St., N. W., Washington 6, D. C.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

Careers in Forestry and Wildlife Conservation. 12 pp. Illus. Univ. of Maine, Orono. 1953.

Directory of Forestry Schools. 299 pp. UN Food and Agric. Org., Rome. Sept., 1953. Forestry and For. Prod. Studies No. 10. $3.00.

Fables for Foresters. Ed. by J. D. Guthrie. Forestry Enterprises, 1740 K St., N. W., Washington 6, D. C. 1953. $3.50.

Forestry Handbook for British Columbia. 363 pp. Illus. The Forest Club, Univ. of B. C., Vancouver 8. 1953. $3.00.

Forestry Schools in the United States. 9 pp. U. S. Forest Serv., Washington 25, D. C. 1953.

Israel. Department of Forests Summary Report for the Year 1952-1953. (Extract from the Hebrew original.) Ilanoth, P. O. Box 88, Nathanya.

The Tree on the Road to Turntown. By G. O. Blough. Illus. by Jeanne Bendick. 48 pp. McGraw-Hill, New York. $2.00. Ages 5-9.

The University of the South Forest; A Demonstration of Practical Applied Forestry for Student Instruction and Regional Use. 124 pp. Illus. Forestry Dept., Univ. of the South, Sewanee, Tenn. 1953.

Conservation

Conservation Law and Administration; A Case Study of Law and Resource Use in Pennsylvania. (Chap. 9-11 on Forestry.) By W. F. Schulz, Jr. 607 pp. Ronald Press, New York. 1953. $10.00.

Present Needs for Research on the Use and Care of Natural Resources. (Chap. 2 on Forestry.) By Committee on Use and Care of Natural Resources, Div. of Biol. and Agric. National Research Council for the Ford Foundation. 35 pp. 2101 Constitution Ave., Washington 25, D. C. 1953. Publ. No. 288. 50 cents.

Forest Economics

Broome County Forest Data; Tables of Basic Information. By J. E. Davis, M. J. Ferree and N. J. Stout. 65 pp. State Univ. of New York College of Forestry, Syracuse. 1953. Bull. No. 27; For. Land Use Study Rept. No. 2. Mimeog.

Lumber Prices and Full Employment. By R. D. Baker; Discussion: John Fedkiw, William Potter. 28 pp. Syracuse Univ. Dept. of Economics, Syracuse, N. Y. 1953. Publ. of the Graduate Econ. Seminar No. 10. 50 cents.

Forest Influences

Vegetation and Watershed Management; An Appraisal of Vegetation Management in Relation to Water Supply, Flood Control, and Soil Erosion. By E. A. Colman. 412 pp. Illus, maps. Ronald Press, New York. 1953. $7.00.

Forest Management

Measure Your Trees—Don't Guess. By Knut Lunnum. 11 pp. Illus. Ext. Serv., State College of Washington, Pullman. 1953. Ext. Misc. Publ. No. 8.

Tree-Volume Tables Based on Forest Site, Adirondack and Catskill Regions of New York State. 8 pp. State Univ. of New York College of Forestry, Syracuse. 1953. Bull. No. 29. 10 cents.

Forest Resources

Census of Woodlands 1947-49; Woods of Five Acres and Over; English County Details. 270 pp. Great Britain Forestry Comm., London. 1953. Census Rept. No. 5. 12s 6d.

Forest Inventory Statistics for Colbert County, Alabama. 16 pp. TVA, Norris. 1953. For. Bull. No. 28. Mimeog.

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An Ecological Study of the Pocket Gopher (Thomomys talpoides tenelius *Goldman*) *in the Jackson Hole Region of Wyoming.* By W. A. Laycock. 8 pp. Wyoming Range Mangt., Laramie. Issue No. 64. November, 1953. Mimeog.

Effect of Grazing Intensity upon Vegetation and Cattle Gains on Ponderosa Pine-Bunchgrass Ranges of the Front Range of Colorado. By W. M. Johnson. 36 pp. Illus. Supt. of Documents, U. S. Govt. Print. Off., Washington 25, D. C. U. S. Dept. Agric. Cir. No. 929. Dec., 1953. 15 cents.

Performance of Weeping Lovegrass under Different Management Practices. By C. E. Denman and others. 18 pp. Illus. Okla. Agric. Expt. Sta., Stillwater. Tech. Bull. No. T-48. October 1953.

Silviculture

Los Chopos y sus Madeiras (Poplars and Their Wood) Vol. I: Los Chopos y sus Cultivos (Poplar growing). By E. G. Vazquez. 318 pp. Ciudad Universitaria, Madrid. 1953. 200 pesetas.

Controlling Upland Hardwoods in South Carolina. By C. W. Hall. 11 pp. Illus. Clemson Agric. Coll., Clemson, S. C. 1953. Cir. No. 385.

Die europäische Lärche in Baden. By Paul Mörmann. 71 pp. Illus. Paul Parey, Hamburg, Germany. 1953. Forstw. Forschungen Hft. 2.

Growth of Planted Red and White Pine in Ohio and Indiana. By R. N. Gaiser and R. W. Merz. 14 pp. Central States Forest Expt. Sta., Columbus 15, Ohio. 1953. Tech. Paper No. 138. Processed.

Die japanische Lärche. By Reinhard Schober. 212 pp. Illus. J. D. Sauerländers. Frankfurt am Main 1. 1953. DM 13.50.

Sprouting of Blackjack Oak in the Missouri Ozarks. By F. B. Clark. 22 pp. Illus. Central States Forest Expt. Sta., Columbus 15, Ohio. 1953. Tech. Paper No. 137. Processed.

Suggestions for Pruning Southern Pines. By G. I. Farin. 7 pp. Illus. Alabama Polytechnic Inst., Auburn. 1953. Leaflet No. 35.

The Tree Species of the Tropical Evergreen Ghat Forests of Kanara (Bombay) and Their Rate of Growth. By G. S. Mathauda. 23 pp. Manager of Publ., Delhi, India. 1953. Indian Forest Bull. No. 169. 2s 3d.

Wood Technology and Utilization

An Atlas of End-Grain Photomicrographs for the Identication of Hardwoods. 87 pp. Great Britain Dept. of Sci. and Indus. Research. Forest Products Research, London. 1953. Bull. No. 26. 12s 6 d (H. M. Sta. Off.).

Basic Data for Oregon Hardwoods. By J. R. Pfeiffer. 40 pp. Oregon Forest Products Lab., Corvallis. 1953. Rept. No. G 2. Mimeog.

Heating Veneer Logs Electrically. By H. O. Fleischer and L. E. Downs. 7 pp. Illus. U. S. Forest Products Lab., Madison, Wis. 1953. Rept. No. 1958. Mimeog.

Paper Birch Utilization in the Lake States. By E. M. Davis. 7 pp. Illus. U. S. Forest Products Lab., Madison, Wis. 1953. Rept. No. 1953. Mimeog.

Some Principles in Lumber Grading. By E. M. Davis. 8 pp. Illus. U. S. Forest Products Lab., Madison, Wis. 1953. Rept. No. 1963.

Utilization of White-Pocket Douglas-Fir: Pulping and Chemical Conversion. By J. S. Martin and others. 9 pp. Tables. U. S. Forest Products Lab., Madison, Wis. 1953. Rept. No. 1961. Mimeog.

Vermont Wood Products Conference (13th) 1953. 55 pp. Norwich Univ., Northfield, Vt.

Society Affairs

Officers and Members of the Council, 1954-1955

E. L. DEMMON, *President*
Southeastern Forest Experiment Station
Federal Building
Asheville, N. C.

DEWITT NELSON, *Vice President*
Department of Natural Resources
State Building 1
Sacramento, Calif.

HENRY CLEPPER, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

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Woodlands Department
Kimberly-Clark Corporation
Neenah, Wis.

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Ann Arbor, Mich.

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College of Forestry
Syracuse 10, N. Y.

C. HUXLEY COULTER
Florida Forest Service
Tallahassee, Fla.

PERCY D. HANSON
U. S. Forest Service
Federal Building
Missoula, Mont.

J. HERBERT STONE
U. S. Forest Service
Post Office Building
Portland 8, Ore.

D. B. DEMERITT
Dead River Company
6 State Street
Bangor, Me.

EDWIN F. HEACOX
Weyerhaeuser Timber Company
Tacoma 1, Wash.

RUTHFORD H. WESTVELD
Department of Forestry
University of Missouri
Columbia, Mo.

A COMPARISON OF S.A.F. EXPENSE AND INCOME FOR 1952 AND 1953, AND THE BUDGET FOR 1954

Item	1952	1953	1954
Expense			
JOURNAL OF FORESTRY	$ 36,701.94	$ 38,167.92	$ 40,000.00
Editor's expense	355.79	443.35	500.00
Salaries, editorial	5,764.62	9,868.40	9,500.00
Salary, executive secretary	11,458.38	9,400.00	9,400.00
Salaries, office	26,609.98	27,470.08	27,800.00
Advertising retainer and commission	7,289.59	9,065.20	9,480.00
Advertising promotion }	1,863.86 }	2,739.81	1,500.00
Advertising expense }	}		500.00
Travel, officers	2,726.12	2,768.69	3,000.00
Postage	1,754.49	1,818.24	2,200.00
Telephone and telegram	458.63	693.93	800.00
Rent	3,528.00	3,528.00	6,318.00
Multigraph and mimeograph	564.10	376.75	500.00
Miscellaneous printing	732.15	784.45	850.00
Office supplies	710.32	1,150.37	1,500.00
General expense	1,390.59	1,367.28	1,500.00
Depreciation	528.84	494.69	600.00
Retirement plan	672.75	1,063.29	1,475.00
Retirement plan, reserve		300.00	640.00
Affiliation dues	200.00	260.00	160.00
Committee expense	36.06	15.60	50.00
Grading forestry schools	56.61	366.50	300.00
Council travel expense	932.12	1,205.49	1,500.00
Division expense	49.21	19.85	50.00
Social Security tax	524.47	575.82	770.00
Section manual	415.89	126.30	50.00
Annual meeting	55.40		
Constitution and bylaws		518.65	
Miscellaneous	56.98	74.12	75.00
Referendum		379.21	
Election of officers and fellows		527.84	
	$105,436.89	$115,569.93	$121,418.00
Income			
Dues	$ 78,425.53	$ 82,488.98	$ 86,500.00
Fees	2,283.25	1,985.82	2,100.00
Sub. and sale of JOURNAL OF FORESTRY	7,115.12	8,874.48	9,500.00
Advertising	17,824.31	22,916.79	25,000.00
Interest and dividends	619.41	576.88	500.00
Miscellaneous income	357.22	915.33	600.00
	$106,624.84	$117,758.28	$124,200.00
Estimated net earnings	$ 1,187.95	$ 2,188.35	$ 2,782.00

The President's Column

E. L. DEMMON

As your President for the coming two years, I wish to express appreciation for the confidence you have placed in me and also to pledge you my wholehearted desire to maintain the Society on a high professional level, serving all the membership to the best of my ability. I am sure that I speak for the entire Council also, in this aim.

The Society is a very complex and cosmopolitan group, including men (and women) working at a great variety of tasks, in all fields of forestry endeavors. It is not a simple matter to satisfy each and every one, but your officers and your staff in Washington are anxious to do everything they can to make you proud of your Society membership, and to improve the standing of our profession throughout the world.

Although your officers have certain responsibilities, the real test of the Society's effectiveness lies at the grass roots, in the activities and affairs of its Chapters, Sections, and Divisions. I urge every one of you to take an active interest in your local groups, attend meetings, select top-notch offi-

FISCAL YEAR MEMBERSHIP CAMPAIGN
SCHOOL BOX SCORE

School	Student applications received: March listing	Student applications received: Total fiscal year
Alabama Polytechnic Institute	3	4
University of California	1	15
Colorado A & M College	1	11
Duke University	0	6
University of Florida	1	13
University of Georgia	9	26
University of Idaho	1	8
Iowa State College	1	21
Louisiana State University	0	5
University of Maine	0	10
University of Massachusetts	0	15
Michigan State College	4	15
University of Michigan	0	7
University of Minnesota	2	17
University of Missouri	0	16
Montana State University	1	8
State University of New York	1	9
North Carolina State College	18	18
Oregon State College	3	9
Pennsylvania State University	2	8
Purdue University	0	18
Utah State Agricultural College	0	7
University of Washington	3	14
West Virginia University	0	6
Yale University	0	0
Total	51	286

FISCAL YEAR MEMBERSHIP CAMPAIGN
SECTION BOX SCORE

Section	Proposed 1954 quota	Applications received[1]: March listing	Applications received[1]: Total fiscal year
Allegheny	100	3	20
Appalachian	100	19	28
Central Rocky Mountain	45	1	13
Central States	110	9	47
Columbia River	140	5	18
Gulf States	105	1	13
Inland Empire	30	1	8
Intermountain	30	1	8
Kentucky-Tennessee	30	0	1
New England	95	2	33
New York	65	3	15
Northern California	120	3	23
Northern Rocky Mountain	30	1	12
Ozark	55	0	21
Puget Sound	80	7	21
Southeastern	145	22	69
Southern California	20	0	0
Southwestern	35	2	4
Upper Mississippi Valley	60	4	42
Washington	45	1	4
Wisconsin-Upper Michigan	60	0	0
Total	1,500	85	400

[1]Student, Junior, Affiliate, Associate (initial) grades only.

cers, and contribute ideas which will make the Society a live and worthy professional organization. Use your local meetings as professional sounding boards to advance forestry and make it of greater value and service to our country.

Several changes are being made in Society committee membership. This is being done partly to rotate assignments, as well as to bring some of the younger men into the picture. I am sure that the old-timers will see the desirability of this. It is already heartening to note that the younger generation of foresters is so much in evidence in Section affairs.

There are still a sizeable number of professional foresters working in forestry or in closely allied fields who are not members of the Society. Keep in mind that we have a goal of 1,000 new members this year. Help bring these nonmembers into the fold.

If you have suggestions for improving our Society, don't keep them to yourself. Your officers will welcome your ideas, so don't hesitate to speak up. However, remember that the more one puts into the Society the more he is likely to gain from it. So I urge you to contribute more—to the JOURNAL, to building membership, and by example, to making the Society an organization of which we can continue to be proud.

E. L. Demmon

C. E. Dunston (1885-1953)

Clarence E. Dunston, a Member of the Society since 1911, died in New Orleans, La, December 18, 1953. He was born in Buffalo, N. Y., March 3, 1885.

Mr. Dunston entered the U. S. Forest Service in 1905, immediately upon graduation from the Biltmore Forest School with the B.F. degree.

Except for the period 1912-1917 when he was employed by the U. S. Indian Service, and the following two years during which he was with the Engineer Corps in France, Mr. Dunston's entire career was with the U. S. Forest Service. After World War I, he worked for the Service in California for 28 years, until his retirement in July 1947.

More on Election of Fellows

I want to go on record as strongly endorsing Munger's opinion re election of Fellows (Page 56, January JOURNAL).

It is all right and highly desirable that the circulators of petitions for Fellowship nomination should get as many signers as possible—in fact, in giving us information upon which to base our judgment in voting, we should be told the total number of signers in each case. But when the nomination completed, the electors should not be pestered with further letters soliciting favorable votes. And it is likely to be embarrassing, too.

In a couple of cases in the recent election, I was very glad that I had sent in my ballot before the arrival of electioneering letters. Let's have more dignified procedure next time.

ROYAL S. KELLOGG
Fellow

January 9, 1954

Munger complains in the January JOURNAL that he and others have been "importuned" to vote for certain candidates for the grade of Fellow. Is that a reprehensible practice? If so, I am one who deserves a rebuke. I wrote some letters of this nature. I also received some letters giving infor-

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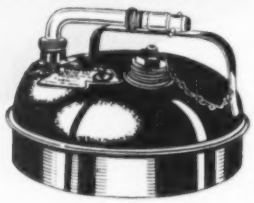

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mation on the qualifications of candidates and I welcomed these letters. Beyond, that, I wrote men whose judgment I valued, seeking information to supplement my own appraisal based on the biographical sketches.

The sketches which accompany the ballots give the candidate's age, degrees, if any, and the positions he has held. If he is an author, a list of books, bulletins, etc., is included. If the candidate is not an author and the elector is not familiar with the accomplishments then the elector must judge the candidate's achievements by the positions he has held. It should be obvious that this is a wholly inadequate test. The conscientious elector should welcome further information.

Because a man has held a high position in an organization, whether in a technical, administrative or an educational capacity, it does not follow that his achievements qualify him for election to the grade of Fellow. It depends what use he has made of his greater opportunities. The fact that a man plays shortstop for the Yankees does not make him eligible for baseball's Hall of Fame. Of course we have no such tangible measures of achievement — batting and fielding averages etc.—as the Baseball Writer's Association uses to guide its choices. It seems likely that the correspondence which Munger does not like, arises from a sincere belief that not enough information concerning the candidates is available to the electors.

Forty of the electors eligible to vote in the 1953 election are retired and, in varying degrees, are losing touch with professional activities. As one of this group, after nearly four years of retirement, I know the difficulty of keeping informed on what foresters are doing elsewhere. I knew twenty of the candidates rather intimately, and was acquainted with an additional ten. The remaining nine I did not feel qualified to judge. In fairness, my failure to vote for them should not have been counted against them.

From a list of thirty-nine candidates we elected nine. I am confident that better information on achievements would have resulted in the election of at least ten more. Of the five candidates from the five southern Sections not one was elected. Several of these men have outstanding achievements to their credit. If it happened in this region it must have happened elsewhere.

I am not suggesting that our Society officers attempt to appraise accomplishments in the sketches which accompany the ballots. I do suggest that we who vote are obligated to qualify ourselves for voting.

CHARLES F. EVANS
Fellow

January 11, 1954

A Message from W. L. Hall, Charter Member

The following letter from William L. Hall of Hot Springs, Ark. is so inspiring as an expression of a forester's faith in forestry and his profession that permission was requested of Mr. Hall to publish it.

As most readers know, Mr. Hall is a charter member and Fellow of the Society. He is active in the management of his own timberlands.

"January 1, 1954

'Society of American Foresters
Washington, D. C.

'Dear fellow members:

"I received yesterday President Drake's letter of December 28th. Complying with his request for prompt payment of membership and section dues for 1954, I am enclosing check covering those items. Further, following his suggestion, I am adding to my check $100 as a contribution to the Society. This is in recognition of my 53 years as a member of the Society and my continuing activities in the practice of forestry.

"To members who know me personally and possibly to others it may be of interest to say that the past ten years have been the most profitable of my life. This is the result of a decision made some 22 years ago, during the great depression of the early thirties.

"At that time cutover timberlands in South Arkansas were considered to have little or no value. I took a chance on some of them I knew quite well and bought them. Some were acquired at tax sales. Almost all of the tracts had some timber of merchantable size as well as areas that had been farmed and were open lands.

"By 1937 industrial conditions had so changed that timber of merchantable size could be sold. I made some sales but limited the cutting to trees I had marked. That plan has been steadfastly followed. It was noted that the stands had some trees that as a result of fires or poor form could never be merchantable. These were girdled and eliminated. Gradually the acreage was increased and sales of timber increased also.

"Some twelve years ago it became possible to organize the tracts on an 8-year cutting cycle and that plan has since been followed. Thus far the writer has marked all trees to be cut and the aim has been to cut not more than one-third of the merchantable trees. The stands run about 90 percent shortleaf and loblolly pine, with red oak, white oak, and gum making up the other 10 percent.

"It is to be noted that as the years pass both the cut and the remaining

stand increase. The cut of 1952 amounted to 216,785 feet of pine and 16,874 feet of oak and gum on 160 acres. The remaining stand is about double these figures and includes many trees above 18 inches in diameter, d.b.h.

"In the past two years I have wondered whether I could hold up to the rough job of marking, but when I got into it I enjoyed it and ended by feeling better than when I started.

Another condition is promising: South Arkansas is fast filling up with well-trained young foresters. When I am past going, I think it may be possible to induce one of them to help me. Anyhow I am keeping on.

"With my very best wishes for the Society and its members personally, I am most happy to continue my membership.

WM. L. HALL"

Appalachian Section Annual Meeting

With a registered attendance of 200, the annual meeting of the Appalachian Section was held in Raleigh, N. C. Jan. 22 and 23.

Fred H. Claridge was chairman of the technical session. It was devoted to papers and discussion of reforestation. The speakers and their subjects were T. E. Maki, artificial reforestation; P. A. Griffiths, seed procurement; C. M. Umland, nursery problems; E. C. Pickens, seedling distribution and survival; Robert Graeber, field planting; George Pettigrew, machine planting; Carl E. Ostrom, tree genetics; and Charles F. Speers, plantation-attacking insects.

At the Section's dinner, Roger Wolcott served as toastmaster, and presented Dr. Richard J. Preston with a testimonial, awarded annually by the North Carolina Forestry Association for outstanding service to forestry. The speaker of the evening was Gus Travis of the Charlotte, N. C. *Observer* who spoke amusingly of his experiences as a newspaper columnist.

At the business session, a report was given by Alvin Hafer on a proposed bill to provide for state certification of foresters in North Carolina. National activities of the Society were discussed by President E. L. Demmon and Henry Clepper, executive secretary.

New officers elected were chairman, P. A. Griffiths, North Carolina Forest Service, Raleigh; vice chairman and chairman of the Membership Committee, John Gray, Extension Service, North Carolina State College, Raleigh; and member of the Executive Committee, E. C. Pickens, South Carolina Forestry Commission, Columbia. R. J. Bartholomew, Virginia Forest Service, Portsmouth, was continued as secretary-treasurer.

Southwestern Section Meeting

The Southwestern Section held its semi-annual meeting, Jan. 15 and 16 in Phoenix, Ariz.

"Big Game Management in Relation to Multiple Land Use" was the theme of the meeting.

Russel Rea, forest supervisor, Kaibab National Forest, presided as chairman. Governor Pyle of Arizona welcomed the Section members to Phoenix.

Papers were presented by Lee Hover, president of the Arizona Game Protective Association; Charles Pace, U. S. Forest Service; H. M. Ratcliff, National Park Service; R. D. Holtz, Bureau of Indian Affairs; Phil Cosper and Dr. Hanson, Arizona Game and Fish Commission; and E. M. Mercer, U. S. Fish and Wildlife Service.

A banquet was held on Friday evening with Supervisor Ed Tucker, Gila National Forest, serving as toastmaster. Guest speaker of the evening was George F. Miller, executive secretary, Roosevelt Council, Boy Scouts of America.

On Saturday morning a panel discussion followed a talk by John G. Babbitt, past president of the Arizona Cattle Growers Association. Messrs. Babbitt, Miller, Hover and John M. Hall, director, Arizona Game and Fish Commission, participated in the discussion under the leadership of Allan G. Watkins of the U. S. Forest Service.

Fifty Society members and guests visited the Science Hall, Arizona State College, at Tempe, on Saturday afternoon. Dr. Herbert L. Stahnke, director of the Poisonous Animals Research

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Width	19¼ inches
Height	24¼ inches

NET WEIGHT

GA-8 (without starter)	115 lbs.
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50	26
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150	22
200	21
250	20
300	16

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Laboratory, exhibited live specimens of all of the venomous animals of the Southwest, and de-bunked a number of popular beliefs with regard to the dangerous qualities of other animals and insects. Dr. Stahnke also explained his "ligature and cryotherapy" method of treating the bites and stings of venomous animals.

K. A. KEENEY.

Section and Chapter Organization

The Society office receives newsletters and material from all Sections and Chapters. Much of it is of interest to other Sections and Chapters, and from time to time we will bring to the attention of such officers procedures and organizational methods that are being used. There follow two items of interest from a Chapter and a Section. Your national office will welcome for publication in the JOURNAL other such procedures which have been found effective in stimulating interest in Section and Chapter activities.

Handbook of Chapter Operations[1]

Preface

This handbook of Chapter operations is offered as an assistance to the chairman and officers in the conduct of Chapter affairs. It has been drawn from the constituted position of the Chapter in the sectional and national framework of the Society, and is coupled with the experience gained from previous Chapter administrations. In brief, it is intended to be an answer to an expressed need. It is the hope of the authors that it may be used as a worthwhile guide toward the fulfillment of Chapter purposes.

The Chapter Bylaws

Whereas certain Chapters of the Society do not function through the formality of bylaws, such were enacted by the West Virginia Chapter at a time early in the creation of Society Chapters. In fact, to gain recognition as a subsection of the Allegheny Section, certain formalities were found to be necessary, including a petition and the subsequent revision of Section bylaws to permit recognition of this, the first Chapter of the Allegheny Section.

In principle, the Chapter bylaws (1) define the purpose of the Chapter, (2) fix the conditions of membership, and (3) provide the framework within which the Chapter functions as a unit of the Society.

In use, bylaws should serve the continued smooth functioning of the organization. The test of their long time usefulness to the Chapter, when viewed at any particular time, is in their workability, being not unduly restrictive of the normal growth and development of the Chapter.

So long as constituted, Chapter bylaws should be fully enforced by Chapter officers.

Organization of the Chapter

Officers.—Chairman, vice-chairman, secretary-treasurer, and executive committee.

Standing committees.—Meetings, nominating, membership, bylaws, resolutions, state forestry administration, newsletter, publicity, and special (program, or subject matter) committees.

Chapter Chairman

Duties and responsibilities.—Promotion of Chapter purposes is gained largely through leadership of the chairman. His tools of accomplishment are the executive committee and the working committees of the Chapter. A program for the year thus centers around the insight, initiative, and executive ability of the elected leader of the Chapter.

He should recognize the need for:

(1) Development of a Chapter program of endeavor for accomplishment, principally during his tenure of office.

(2) Organizing the membership toward meeting his program objectives.

(3) Coordinating Chapter affairs, and giving direction to them; making committee appointments.

(4) Representing the Chapter, and the Society largely, in its relations with the public.

(5) Maintaining cordial and business-like relations of the Chapter with the Section and the national office.

(6) Conducting the annual and such other meetings of the Chapter as are staged.

(7) Upholding the constitution and bylaws of the Society broadly in conducting the affairs of the Chapter.

Chapter Vice-Chairman

Duties and responsibilities.—The vice-chairman gives leadership to the Chapter membership committee, acquaints himself with the Chapter program of the year, and at meetings takes the chair in the absence of the chairman, or when the chairman leaves the chair to take part in proceedings.

Chapter Secretary

Duties and responsibilities.—Within the secretary's position centers much of the day-to-day workings of the Chapter. He:

(1) Keeps a record of the proceedings of the Chapter. At meetings he keeps minutes, recording accurately and fully the acts done, and making entries of those things which have been voted upon and passed.

(2) Receives and holds all moneys due the Chapter, pays out on its orders, and keeps accounts in detail of all moneys received and paid out. Reports in full

[1] Frayer, Hume C. and Milton Harr. Your year as Chapter chairman. Prepared by the West Virginia Chapter, Allegheny Section, Society of American Foresters. 1953.

for all moneys whenever the Chapter may ask, giving a clear and correct statement of its financial condition.

(3) Writes all letters, orders, etc., as the Chapter may direct.

(4) At meetings, calls to order in the absence of officers entitled to the chair, and presides until the election of a chairman pro tem.

(5) Forwards advance notice of Chapter meetings to the Section chairman and secretary.

(6) Submits annually to Section executive committee before February 1, a report of Chapter activities.

(7) Submits to the Curator, West Virginia Collection, the Library, West Virginia University, Morgantown, two copies of each Chapter publication, such as the Newsletter or Annual Reports, etc., at time of issuance.

(8) Submits to the Senate Clerk, Legislature of West Virginia, State Capitol, Charleston, promptly on election to office the names, titles, and cities of residence of Chapter officers for the new Chapter year for inclusion in the *West Virginia Bluebook*.

Executive Committee

This executive committee comprises the chairman, vice-chairman, secretary, and two additional elected members. It is the executive body of the Chapter. Aims and objects of the program year are developed in and given voice by the executive committee, under the direction of the chairman. Matters arising, or placed before the Chapter for broad consideration and action are customarily resolved by the executive committee. It acts as a consultative body for the chairman, meeting at the direction of the chairman.

The executive committee is considered to be vested with most of the powers and authority of the Chapter, only distinguishing between policy matters of the broadest scope in deferring such matters to the full membership.

Committees

Meetings.—The annual meeting of the Chapter is arranged by the meetings committee, as are all other meetings.

The time and place of the annual meeting, as well as the program agenda are subject to approval of the executive committee. This need is met in a preliminary way by a joint meeting of the executive and meetings committees called by the Chapter chairman early in the year.

A successful Chapter year is reflected in an equally successful annual meeting. Much thought and planning effort must necessarily be given to the program. Equally important to the Chapter chairman is the business session, where much of the Chapter work is culminated in this session.

Suggestions to the meetings committee in the conduct of the annual meeting are:

(1) The customary opening evening session should feature a keynote speaker of some recognition. He may be of regional or national importance.

(2) The expense of securing a speaker should be cleared with the executive committee well in advance of final program arrangements.

(3) When confirming the engagement of the several program speakers they should be invited to furnish the committee with their talk or technical paper in quantity for distribution at the meeting.

(4) Arrangements should also include soliciting West Virginia University, Northeastern Forest Experiment Station, and other sources of recently published forestry bulletins for display and distribution at the meeting.

(5) The "atmosphere" of the annual meeting can easily be enhanced by the promotion of use of small exhibits on various phases of forestry.

Nominating.—The nominating committee activates Section 6 of the Chapter bylaws.

Appointment of the nominating committee has customarily been made early in the Chapter year. This action avoids any last minute effort in the development of a slate of new officers. The nominating committee should plan a meeting midway in the year, develop its new-officer slate, secure agreement of the men to appear on the slate, and provide a full ballot of such nominees for distribution and use when electing officers. The committee chairman should submit his report in this ballot form, at the same time pro-

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viding on the ballot form the space necessary for names nominated from the floor.

The position of secretary-treasurer has been viewed of late as of two years in duration, with prospective incumbents solicited on this basis. For the guidance of Chapter chairman, the members of the nominating committee can well be made up of past Chapter chairmen, the immediate past Chapter chairman appointed as chairman of this committee.

Standing.—These committees carry over from one year to another, providing much of the framework to the conduct of continuing Chapter activities. They are ordinarily created or dissolved during annual business meetings. The Chapter chairman, assisted as may be desired by the executive committee, is expected to advise the membership relative to the need for changes in standing committees.

Special (Program or Subject Matter).—These committees are keyed more nearly to current year activities of the Chapter. They reflect the action program of the Chapter, professionally, and as to projects and current issues under consideration. Need for such ordinarily arises out of open forum at annual meetings, and are set up at such time by the Chapter chairman, or independently by the chairman during program-planning activities of the executive committee. With their purposes fulfilled, such committees are ordinarily discharged during the course of annual business meetings.

Section Membership Participation

One way effectively to encourage member participation, according to the executive committee of the Kentucky-Tennessee Section, is to assign members to committees in which they have a particular interest or preference.

In their December newsletter were listed the committees, their responsibilities, and the names of the chairmen. A postcard was enclosed with the newsletter also listing the committees, with a blank space opposite the name of each. Each Section member was requested to indicate his interest or preference, by priority—1, 2, and 3.

By this method a member has the opportunity to select committee assignment in that field in which he is most interested and presumably qualified to serve. Consequently, the overall effort of the Section should prove most effective.

Society Occupies New Offices

On February 1st the Society moved to larger quarters in the Mills Building. Society members are urged to visit these new offices when in Washington, and to meet members of the staff. The entrance room number is 425.

For several years the Society has had three separate offices in the Mills Building on two different floors. While it was realized that this was an inefficient way to function, high rental in other buildings and moving costs made a change financially inadvisable. However, the Society now has adequate space in contiguous rooms, which will permit more efficient operation. Also we will have at hand, for the first time since the establishment of a Society office, back copies of the Society's publications. Until now these back issues have been kept in a downtown storage house at considerable inconvenience and expense.

Tax Exemption for Self-Employed New York State Foresters

New York State requires the filing of the Unincorporated Business Tax (Form 202) "by every individual, partnership, trust, estate, or other entity carrying on an unincorporated business within New York State, if gross income received amounted to more than $10,000, or if net income amounted to more than the exemption allowed."

Exempted from the tax is income received from any *profession* "from which more than 80 percent of the gross income is derived from the personal services actually rendered by the individual, and in which capital is not a material income producing factor." The professions of law, medicine, dentistry, and architecture are specifically exempted by name; the profession of forestry is not.

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The Society of American Foresters was requested, by a member of the New York Section, to prepare a statement for the State Tax Commission substantiating the claim that forestry is a profession and that accordingly self-employed professional foresters should not be required to file Form 202 in New York State. The statement submitted explained the professional nature of an education in forestry, the professional status of forestry, and the profession's code of ethics. Examples were cited to show that the legislature of New York, the United States Office of Education, and the American Council on Education recognize the professional nature of the specialized education necessary to a career in forestry.

The Society has been informed by a New York Section member, who is a consulting forester, that his request for exemption has been granted. The Department of Taxation and Finance has informed him that "it will be held that the income from your activities as a consultant forester . . . constitutes income from the practice of a profession and is accordingly exempt from the unincorporated business tax."

Thus, in New York State the Department of Taxation and Finance officially recognizes forestry as a profession.

E. J. Mead
(1885-1953)

Ernest J. Mead, district forester of the Louisiana Forestry Commission, Hammond, died December 28, 1953. He was born in Wisconsin, August 17, 1885.

Mr. Mead had practiced forestry for 45 years with state, federal, and private agencies. He had been district forester at Hammond since 1944.

Following forestry study at the University of Michigan he worked for the U. S. Forest Service for 17 years, resigning to do forestry work for the Texas Oil Company. Before assuming charge of the Hammond office, which is headquarters for state forestry work throughout the Florida parishes, Mead was an assistant state forester in charge of management.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of January are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of April 1, 1954. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Drake, D. G. Holm, D. S.

Junior Grade

Betler, G. A., County Forester, Helvetia, W. Va.; West Va. Univ., B.S.F., 1951.

Greth, J. W., 134 S. Gill St., State College, Pa.; Pa. State, B.S.F., 1954 (Student, 1953).

Sopper, W. E., 107½ S. Allen St., State College, Pa.; Pa. State, B.S.F., 1954. (Student, 1953).

Member Grade

DeLong, T. S., Research Forester, Pa. Dept. For. & Waters, Mont Alto, Pa. (Junior, 1947).

Dolton, R. L., Dist. Forester, Pa. Dept. For. & Waters, Fayetteville, Pa.; Pa. State, B.S.F., 1938. Reinstatement.

Streator, H. S., Forester, Dept. For. & Waters, Corsico, Pa. (Junior, 1947).

Sweitzer, M. D., Consulting Forester, Reading, Pa. (Junior, 1934).

Appalachian Section

Student Grade

NORTH CAROLINA STATE COLLEGE

Archer, J. M.	Manucy, O. A.
Brown, J. B.	Payne, B. B.
Frazier, T. R.	Rayburn, E. J.
Gallup, L. E.	Rigouard, E. F.
Groves, F. R.	Robinson, J. F.
Hardy, P. L.	Smith, D. R.
Hill, N. E.	Swift, J. G.
Lankford, R. B.	Tekel, J. E.
Larkey, B. J.	Wells, J. J.

Junior Grade

Parker, F. C., Dist. Forester, Champion Paper & Fiber Co., Edgefield, S. C.; Univ. of Ga., B.S.F., 1948 Reinstatement

Member Grade

Aldrich, F. H., Forester, Gair Woodlands, Allendale, S. C. (Junior, 1947).

Allison, J. R., Consulting Forester, Florence, S. C. (Junior, 1947).

Avedisian, H., Forester, S. C. Comm. of Forestry, Newberry, S. C. (Junior, 1947)

Green, W. W., Forester, Lincoln Green Dem. Forest, Dorchester, S. C. (Junior, 1947).

Labyak, L. F., Forester, U. S. Army, Fort Jackson, S. C. (Junior, 1947).

Middleswart, E. L., Dist. Forester, S. C. Comm. of Forestry, Newberry, S. C. (Junior, 1947).

Schmidt, J. A., Consulting Forester, Charleston, S. C. (Junior, 1947).

Watkins, V. G., Farm Forester, N. C. Forest Service, Durham, N. C. (Junior, 1947).

Affiliate Grade

Jamison, O. T., Asst. Dist. Ranger, U.S.F.S., New Bern, N. C.; Va. Polytechnic Inst., B.S., (Forestry), 1950.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Cole, W. Q.

Member Grade

Buehling, S. H., Asst. Ranger, Walden, Colo. (Junior, 1947).

Harris, H., Dist. Ranger, U.S.F.S., Wapiti, Wyo. (Junior, 1947).

Kennedy, D. M., Dist. Ranger, Meeker, Colo. (Junior, 1947).

LaNoue, F. D., Asst. Park Supt., Estes Park, Colo. (Junior, 1947).

Mitts, S. R. M., Asst. Ranger, U.S.F.S., Cody, Wyo. (Junior, 1947).

Riordan, L. E., Coordinator, Colo. Game & Fish Comm., Denver, Colo. (Junior, 1947).

Sykes, J. T., Dist. Ranger, U.S.F.S., Beulah, Colo. (Junior, 1947).

Troxell, H. E., Asst. Prof., Colo. A & M College, Fort Collins, Colo. (Junior, 1947).

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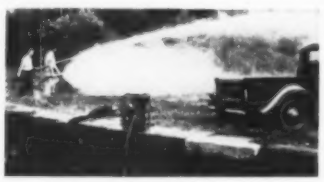

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Central States Section

Student Grade

MICHIGAN STATE COLLEGE

Marx, R. P. Melcher, W. M.
McCoy, H. W. Reynolds, E. J.

Junior Grade

Ching, K. K., Photo Interpretor, Abrams Aerial Survey, Lansing, Mich.; Mich. State College, M.F., 1948.
McDowell, W. J., Supervisor, Northern Tree Co., Petoskey, Mich.; Michigan State College, B.S.F., 1939.
Michel, R. W., 6136 S. Justrie, Chicago, Ill.; Purdue Univ., B.S.F., 1954. (Student, 1952).
Quaile, G. E., 1446 Univ. Terrace, Ann Arbor, Mich.; Univ. of Mich., M.F., 1954. (Student, 1952).
Reed, M. O., 724 E. 29th St., Marion, Ind.; Purdue Univ., B.S.F., 1954. (Student, 1952).
Smith, R. N., Research Forester, U.S.F.S., East Lansing, Mich.; Univ. of Mass., B.S.F., 1949.
Westell, C. E., Research Asst., Univ. of Mich., Ann Arbor, Mich.; Univ. of Mich., B.S.F., 1950; M.W.M., 1951.

Member Grade

Lamy, J. C., Dist. Forester, Dept. of Cons. Grayling, Mich.; Univ. of Mich., B.S.F., 1947. (Junior, 1947).
Ralston, R. A., Research Forester, Lake States Forest Exp. Sta., E. Lansing, Mich.; Univ. of Mich., M.F., 1949. (Junior, 1950).

Affiliate Grade

Lizenby, G. W., Forester, Dept. of Cons., Lansing, Mich.; Mich. College of Mining & Tech., B.S., (Forestery), 1953.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Horton, B. R. Westrate, C. G.
Parks, G. K.

Junior Grade

Hubbard, W. G., Forester, H. G. Chickering Jr., Consulting Photo., Eugene, Ore.; Oregon State College, B.S.F., 1948. Reinstatement.
Palmquest, J. A., Handy Rigger, Weyerhaeuser Tbr. Co., Longview, Wash.; Univ. of Mich., M.F., 1952.
Sullivan, L. J., Dist. Ranger, Ochoco Natl. Forest, Prineville, Ore.; Oregon State College, B.S.F., 1939.

Member Grade

Adams, R. S., Logger, 348 E. Street S., Lakeview, Ore. (Junior, 1946).
Adams, T. C., Forest & Rge. Expt. Sta., Portland, Ore. (Junior, 1940).
Ash, B. H., Dist. Ranger, U.S.F.S., McKenzie Bridge, Ore. (Junior, 1947).
Benecke, W. O., Umpqua Natl. Forest, Roseburg, Ore. (Junior, 1946).
Bjorge, W., Bur. of Land Mgmt., Portland, Ore. (Junior, 1946).
Carnegie, J. A., Forester, 622 W. 2nd St., Medford, Ore. (Junior, 39R50).
Collard, C. G., Forester, Crown Zellerbach Corp., Stevenson, Wash. (Junior, 1946).
Coons, H. S., Forest Supv., 1940 Myrtle, Baker, Ore. (Junior, 36R48).
Buberow, B. G., Forester, Ochoco Rgr. Sta., Prineville, Ore. (Junior, 1947).
Erickson, E. A., Forest Engr., 4th & Terrace, Roseburg, Ore. (Junior, 1947).
Gedney, Don, U.S.F.S., Portland, Ore. (Junior, 1946).
Hall, H. V., Farm Forester, 1101 S. 3rd St., Kelso, Wash. (Junior, 1945).
Howard, E. W., Forester, U.S.F.S., Beaverton, Ore. (Junior, 1946).
King, R. M., Forester, Crown Zellerbach Corp., Molalla, Ore. (Junior, 1947).
Lord, C. M., Forester, Willamette Natl. Forest, Oakridge, Ore. (Junior, 1947).
Miller, O. R., Asst. Logging Engr., Longview Fiber Co., Longview, Wash. (Junior, 1947).
Morrison, V. L., Forester, State Bd. of Forestry, Salem, Ore. (Junior, 1946).
Olson, V. N., Dist. Ranger, Wind River Ranger Sta., Carson, Wash. (Junior, 1947).
Palmer, M. A., Forester, A. Morrison Lbr. Co., Burns, Ore. (Junior, 1947).
Pope, R. B., Forest & Rge. Exp. Sta., Portland, Ore. (Junior, 1947).
Raynor, C. W., Logging Engr., Booth-Kelley Co., Eugene, Ore. (Junior, 1947).
Sargent, W. F., Forester, State Bd. of Forestry, Forest Grove, Ore. (Junior, 1947).
Scott, F. W., Industrial Forester, Scottsburg, Ore. (Junior, 1939).
Silen, R. R., Forester, McKenzie Rgr. Sta., McKenzie Bridge, Ore. (Junior, 1947).
Thomas, G. M., 735 E. Franklin, Bend, Ore. (Junior, 1947).
Udell, B., Consulting Forest Engr., Lebanon, Ore. (Junior, 1947).
Warg, S., Logger, Box 710, Roseburg, Ore. (Junior, 1947).
Wilt, W. L., Forester, Fischer Lbr. Co., Marcola, Ore. (Junior, 1946).

Gulf States Section

Junior Grade

Marsh, R. C., Forester, Keith Cranston & Assoc., Leland, Miss.; Iowa State College, B.S.F., 1951.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Matzner, F. T.

Intermountain Section

Junior Grade

Anderson, D. V., Forester, Boise Fayette Lbr. Co., Cascade, Idaho; Univ. of Idaho, B.S.F., 1950.
Granfelt, C. E., Forester, Bur. of Land Mgmt., Fillmore, Utah; Utah State Agric. College, B.S.F., 1954. (Student, 1951).

Kentucky-Tennessee Section

Junior Grade

Markham, T. M., Asst. Forester, Dept. of Cons., Jackson, Tenn.; Univ. of Mich., B.S.F., 1940. Reinstatement.

New England Section

Junior Grade

Merrill, B. D., Farm Forester, Maine Forest Serv., Dover Foxcroft, Maine; Univ. of Maine, B.S.F., 1953.
Robbins, W. C., East Vassalboro, Maine; Univ. of Maine, B.S.F., 1954. (Student, 1952).

Member Grade

Bissell, L. P., Ext. Forester, Univ. of Maine, Orono, Maine; Yale Univ., M.F., 1947 (Junior, 1948).

Affiliate Grade

Leonard, R. E., County Forester Aide, Vermont Forest Serv., Ludlow, Vt.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Morse, J. E.

Junior Grade

Carsten, R. C., Asst. Farm Mgr., Deer Valley Farm, Guilford, N. Y.; State Univ. of N. Y., B.S.F., 1952.
Parslow, D. F., R.D. 1, Hartwick, N. Y.; State Univ. of N. Y., B.S.F., 1954. (Student, 1952).
Wobrock, P. G., Senior Draftsman, Allegany State Park, Red House, N. Y.; Colo. A & M College, B.S.F., 1952.

Member Grade

Hoyt, G. J., Instructor, Paul Smith's College, Paul Smiths, N. Y. (Junior, 1947).
Huber, E. H., Forester, Bur. of Forest Mgmt., Altamont, N. Y. (Junior, 1947).
Johnson, E. W., Asst. Proj. Forester, Syracuse, N. Y. (Junior, 1947).
Schmid, M. D., Treas. & Gen. Mgr., Champlain Forest Ind., Westport, N. Y. (Junior, 1946).
Welch, F., College of For., State Univ. of N. Y., Syracuse, N. Y. (Junior, 1945).
Whyland, R. C., Woodlands Mgr., Finch-Pruyn Co., Glens Falls, N. L. (Junior, 1947).

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Ferrin, D. L.

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Junior Grade

Haske, C. A., Forestry Aide, U.S.F.S., Adin, Calif.; Colo. A & M College, B.S.F., 1952.

Member Grade

Angwin, E. L., Dist. Forest Rgr., U.S.F.S., Covelo, Calif. (Junior, 1946).
Carleton, W. A., Forester, Winton Lbr. Co., Pine Grove, Calif. (Junior, 1947).
Gilmore, D. M., Fire Fighter Foreman, Calif. Div. of For., Redding, Calif.; Mich. State College, B.S.F., 1950. (Junior, 1950).
Herbert, A. W., Forester, Stockton Box Co., Placerville, Calif. (Junior, 1947).
Hofsted, E. A., 1329 Balif Street, Roseburg, Ore. (Junior, 1947).
Michels, J. H., Dist. Forest Rgr., Sierra Natl. Forest, Mariposa, Calif. (Junior, 1945).
Phillips, C., Forest Rgr., Calif. State Div. of Forestry, Yreka, Calif. (Junior, 1947).
Reinecker, H. P., Forest Rgr., Calif. State Div. of Forestry, Marysville, Calif. (Junior, 1947).

Affiliate Grade

Hayes, A. J., Forest Rgr., State of Calif., Grass Valley, Calif.

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Dahl, J. R.

Ozark Section

Junior Grade

Biswell, C. R., 401 Hirth, Columbia, Mo.; Univ. of Mo., B.S.F., 1954. (Student, 1952).
Davis, J. T., 106 S. 10th St., Columbia, Mo.; Univ. of Mo., B.S.F., 1954 (Student, 1952).
Ross, K. C., R.F.D. 1, New Hampton, Mo.; Univ. of Mo., B.S.F., 1954. (Student, 1952).

Member Grade

Bergmann, H. A., U.S.F.S., Booneville, Ark. (Junior, 1947).

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Beauchamp, V. H. — Polley, G. J.
Cole, D. W.

Junior Grade

Brynestad, K. W., Forester, Rayonier, Inc., Hoquiam, Wash.; Univ. of Wash., B.S.F., 1953.
Hollinshead, D. J., Asst. Dist. Warden, State Forestry, Raymond, Wash.; Univ. of Wash., B.S.F., 1950.

Member Grade

Anderson, T. M., Asst. Dist. Forest Warden, State Div. of Forestry, Clear Lake, Wash.; Univ. of Wash., B.S.F., 1948. (Junior, 1948).
Forristall, F. F., Grad. Student, Univ. of Wash., Seattle, Wash.; Univ. of Wash., B.S.F., 1950. (Junior, 1950).
Lewis, F. E., Dist. Rgr., Mt. Baker Natl. Forest, Marblemount, Wash.; Univ. of Wash., B.S.F., 1949. (Junior, 1950).
Soderberg, P. E., Chief Forester, Biles-Coleman Lbr. Co., Omak, Wash.; Univ. of Wash., B.S.F., 1939. (Junior, 1949).
Taylor, W. R., Forester, U.S.F.S., Glacier, Wash.; State Univ. of N. Y., B.S.F., 1948; Univ. of Idaho, M.S., 1949. (Junior, 1949).

Affiliate Grade

Ohrmund, G. A., Conservationist, Soil Cons. Service, Port Townsend, Wash.; Wash. State College, B.S., (Forestry), 1951.
Yonke, R. A., Forestry Aide, Skykomish Tree Farm, Weyerhaeuser Tbr. Co., Monroe, Wash.; Wash. State College, B.S., (Forestry), 1953.

Southeastern Section

Student Grade

ALABAMA POLYTECHNIC INSTITUTE

Saunders, C. V. — Slay, R. T.
Smith, D. E.

UNIVERSITY OF FLORIDA

Lindau, A. H.

UNIVERSITY OF GEORGIA

Baker, W. A. — Shelhorse, A. W.
Cole, R. S. — Thomas, W. P.
Herndon, A. J. — Williams, M. F.
Hogan, L. C. — Watts, G. M.
McCorkle, J.

Junior Grade

Arnbal, A. K., Box 488, Athens, Ga.; Univ. of Ga., B.S.F., 1953. (Student, 1952)
Burgin, R. F., Owner, Arlington Box Co., Arlington, Ga.; A.P.I., B.S.F., 1950.
Burtz, O. C., Dist. Forester, Ga. For. Comm., Gainesville, Ga.; Univ. of Ga., B.S.F., 1948.
Carnes, E. T., County Rgr., Box 166, Gray, Ga.; Univ. of Ga., B.S.F., 1947.
Edenfield, R. J., Farm Forester, Fla. Forest Service, Tallahassee, Fla.; Univ. of Fla., B.S.F., 1950.
Hampton, L. A., Commerce, Ga.; Univ. of Ga., B.S.F., 1953. (Student, 1953).
Hogan, L. D., 3692 Atlanta Ave., Hapeville, Ga.; Univ. of Ga., B.S.F., 1953. (Student, 1952).
Huntley, R. C., Asst. Prof., A.P.I., Auburn, Ala.; State Univ. of N. Y., B.S.F., 1953.
Lynch, T. J., 94 Karland Dr., Atlanta, Ga.; Univ. of Ga., B.S.F., 1953. (Student, 1952).
Park, G. H., 415 10th Ave., N.E., St. Petersburg, Fla.; Univ. of Fla., B.S.F., 1954. (Student, 1952).
Riggs, R. H., Div. Supv., So. Bell Telephone Co., Birmingham, Ala.; A.P.I., B.S.F., 1950.
Smith, R. A., Box 1237, Albany, Ga.; Univ. of Ga., B.S.F., 1953. (Student, 1952).
Walsh, C. S., Grad. Asst., A.P.I., Auburn, Ala.; A.P.I., B.S.F., 1950.
Williams, H. W., Asst. Dist. For. Mgr., Ga. For. Comm., Waycross, Ga.; Univ. of Ga., B.S.F., 1949.
Wright, J. P., Forester, Union Bag & Paper Co., Savannah, Ga.; Yale Univ., M.F., 1949. Reinstatement.

Member Grade

Baker, G. F., Refuge Mgr., S. Fla. Fed. Bird Refuge, Dania, Fla. (Junior, 1937).
Clancy, E. J., Consulting Forester, 1916 Sylvan Rd., S. W., Atlanta, Ga. (Junior, 1936).
Morris, G. A., Box 367, Ludowici, Ga. (Junior, 1947).
Parnelle, R. E., Forester, Southlands Plantation, Bainbridge, Ga. (Junior, 1947).
Vivaldi, S. A., Ext. Forester, Agric. Ext. Ser., Rio Piedras, Puerto Rico. (Junior, 1947).
Wadsworth, F. H., Chief, Div. of For. Mgt. Res., U.S.F.S., Rio Piedras, Puerto Rico. (Junior, 1939).

Affiliate Grade

Heidema, E. J., Sec., American For. Prod. Inc., Mobile, Ala.; Agric. Univ. Wageningen (Holland), L.I., 1934.

Southwestern Section

Junior Grade

Morlock, J. F., Forest Supv., U. S. Indian Serv., Peach Springs, Ariz.; Iowa State B.S.F., 1946.

Affiliate Grade

Pomeroy, J. S., Dist. Rgr., U.S.F.S., Globe, Ariz.

Upper Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Rawley, J. E.

UNIVERSITY OF MINNESOTA

Bakuzis, E. V. — Cong, R. B.

Junior Grade

Allen, M. R., Forester, Halvorson Trees, Duluth, Minn.; Iowa State, B.S.F., 1949.

Member Grade

Anderson, R. L., Pathologist, Lake States For. Exp. Sta., St. Paul, Minn.; University of Minn., B.S.F., 1947; M.S., 1949; Ph.D., 1952. (Junior, 1950).
Vasilevsky, A. M., Forester, Iron Rge. Res. and Rehabil. Comm., St. Paul, Minn.; Univ. of Minn., M.S., 1952. (Junior, 1949).

Washington Section

Junior Grade

Lord, W. L., 4325 Halley Terrace, S.E., Washington, D. C.; Pa. State Univ., B.S.F., 1952.

Forestry News

Effect of USDA Reorganization on Forest Service

On November 2, Secretary of Agriculture Ezra Taft Benson announced a reorganization of his department to be effective as soon as practicable. By January 3, 1954, changes concerning the Forest Service were put into effect.

Under the new organization, the Forest Service has responsibility for land utilization projects formerly administered by the Soil Conservation Service, and the research and control work in forest insects and diseases formerly administered by the Agricultural Research Service. Certain grass and range research on non-forest grazing lands not adjacent to or integrated with national forest ranges is transferred to the Agricultural Research Service.

This last means that range research in the Great Plains region, specifically the Central Plains Experimental Range at Munn, Colo., and the U. S. Range Livestock Experiment Station at Miles City, Mont., as well as the Jornada Experimental Range in New Mexico will be transferred to the Agricultural Research Service. This will leave in the Forest Service all the research relating to the management of forest ranges and adjacent integrated non-forest ranges. Agricultural Research Service will carry on all research on range reseeding, range weed and brush control and range fertilization.

Those activities being transferred to the Forest Service can be summarized as follows:

The 90 land utilization projects covering 7,275,004 acres of submarginal land not suitable for agriculture, were acquired by the Department of Agriculture in the late 1930's to correct maladjustments in land use. The projects scattered throughout the country vary in size from 465 acres to 1,024,594. About 26 percent of this land is under the direct administration of the federal government; 69 percent is under 10-year lease to local agencies; and 5 percent is under long-term leases to non-federal public agencies. Plans are now underway to transfer this latter class—those under long-term lease to the lessees.

Research and control work on forest insects and diseases is transferred to the Forest Service. The basis for lining up activities as he did was given in October by Secretary Benson in his announcement of intention to reorganize, as follows: "Forest Service. This Service would continue to be responsible for promoting the conservation and best use of the nation's forest resources." The reorganization aims to bring together all functions contributing to this objective. Thus it is desirable to have in one agency the scientists who are engaged in research leading to the discovery or improvement of better methods of controlling insects and diseases attacking forest trees and forest products. This does not include insect identification and classification, research on insecti-

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The authors believe that the best way to teach forest mensuration is to teach the student how to use its tools. The arrangement of material follows a classification of the technique required, rather than the subject to be studied. All common problems of mensuration are illustrated by modern practices, and a chapter has been added on the mensurational phases of using aerial photographs in timber cruising.

FOREST PATHOLOGY

By JOHN S. BOYCE, Department of Forestry, Yale University. *American Forestry Series.* Second edition. 526 pages, $6.00.

This revision now includes a wealth of information on such topics as salt spray injury, Phymatotrichum root rot, phloem necrosis of elm, Adelopus needle cast of Douglas fir, septoria canker of poplars, canker stain of plane tree, oak wilt, mimosa wilt, persimmon wilt, and several other rots. New material has been included on the prevention and control of the deterioration of wood in service.

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cides or fungicides, or insects and diseases of shade trees or ornamentals including the gypsy moth, all of which remain in Agricultural Research Service.

Reorganization of National Park Service

Reorganization of the National Park Service has been announced by the Department of Interior, the result of recommendations by a management survey committee set up by Secretary Douglas McKay. Principal changes, designed to reduce administrative costs and improve efficiency, are expansion of the field organization from four regional offices to six, and creation of two offices for design and construction.

The plan is intended to place greater responsibility on field officials and remove from Washington much routine work and technical supervision, service officials said.

The two new regional headquarters will be at Philadelphia and St. Louis. The other four will remain where presently located. The new regional organization thus will have offices as follows: northeast, Philadelphia; southeast, Richmond, Va.; central, St. Louis, Mo.; Rocky Mountain, Omaha, Neb.; southwest, Santa Fe, N. Mex.; Pacific coast, San Francisco.

The two central design offices will be located at Philadelphia and San Francisco, serving the eastern and western areas respectively. Architects, landscape architects, and engineers will have headquarters in these offices.

Fontanna and White Named A.F.A. Directors

Stanley G. Fontanna, dean of the School of Natural Resources, University of Michigan, and George O. White, state forester of Missouri, have been elected to three-year terms as directors of the American Forestry Association.

* * *

Woodland pastures averaged only about 275 pounds of dry forage an acre compared to improved open pasture which produced from 4,000 to 6,000 pounds according to recent findings of the University of Wisconsin College of Agriculture. The open pasture provided 31 times as much protein as the wooded pastures. Soil tramplings due to grazing in the woodland increased the water runoff from 197 gallons to 9,308 gallons per acre in one year.

Clarence Prout Named Minnesota Deputy Conservation Director

Clarence Prout, director of the Division of Forestry of the Minnesota Department of Conservation, has been named deputy commissioner of conservation. He succeeds E. V. Willard who retired. E. L. Lawson, deputy director of the forestry division, has been appointed director of that division.

CLARENCE PROUT

Frances Flick to Study Library Methods in England

Frances Flick, forestry bibliographer at the U. S. Department of Agriculture Library, is spending March and April of this year in Oxford, England. She is studying documentation methods employed by the Commonwealth Forestry Bureau, publishers of *Forestry Abstracts.*

Tree Improvement Committee Meets at Forest Products Lab.

A year's progress of the Lake States Forest Tree Improvement Committee since its organization in 1953 was reported at the first annual meeting of the committee at the Forest Products Laboratory, Madison, Wis., in January.

Paul O. Rudolf, of the Lake States Forest Experiment Station, St. Paul, Minn., committee chairman, outlined the overall work that has been done on plans that will lead to seed certification as part of the program to encourage and coordinate forestry improvement through genetical research.

The report will be revised in line with the discussion by committee members. The revision will include spe-

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cific recommendations for selecting superior stands of forest trees and subsequent selection of outstanding trees for breeding to determine if superior characteristics will be inherited in the progeny. The reproduction will be both by controlled pollination and by vegetative propagation by grafting and rooting.

The committee is composed of 16 representatives (state, federal, and industrial foresters) of the Lake States area. The group is one of a number that have been formed in various parts of the United States since the program was initiated by the organization of the Institute of Tree Genetics in California about 1920.

Private and Industrial

Foresters Employed by Southern Pulp and Paper Industry

The following statistics on the number of foresters employed by the pulp and paper industry in the South were compiled by Henry Malsberger, forester-manager of the Southern Pulpwood Conservation Assn., Atlanta, Ga.

"There were 12 conservation foresters in 1946; 96 in 1951; and 126 in 1953. This is an average yearly increase of 14. Foresters employed in land management and wood procurement, not working with conservation on non-company land, totaled 253 in 1946; 465 in 1951; and 627 in 1953. The industry now employs 753 graduate foresters in all categories, compared with 265 in 1946, and 561 in 1951. There are also 95 nontechnical trained woodsmen assisting the conservation foresters in the small landowner program."

H. D. Bennett Named To N.L.M.A. Advisory Committee

Howard D. Bennett, forester for the Appalachian Hardwood Manufacturers, Inc., has been named chairman of the Forestry Advisory Committee of the National Lumber Manufacturers Association.

Forest Farmers Plan Annual Award

The Forest Farmers Association has announced the creation of an annual award to be given an individual who has made "an outstanding contribution to the advancement of private forest endeavor and full forest development in the South."

President J. V. Whitfield of the F.F.A. has announced that the award will be presented for the first time at the 1954 Southern Forestry Conference banquet in Asheville, N. C., April 27.

The individual to receive the award will not be a professional forester, and the award will be presented for reasons of regional importance or at least of statewide importance.

Kentucky Bankers Form Forestry Committee

Formation of a state-wide forestry committee has been announced by the Kentucky Bankers Association.

The group, as a sub-committee of the agricultural committee, will be concerned with two main objectives: first, keeping in close touch with educational, research, and industrial organizations working in forestry in Kentucky; secondly, recommending to the agricultural committee ways and means by which the bankers of Kentucky may more effectively advance the forestry program of the state.

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Earl L. Grinols of Grinols Implement & Fuel Co. of Bemidji, Minnesota, has realized for over ten years that there was a tremendous future in wood treating. However, at that time, he inquired and found that it would cost around $50,000 to build a pressure treating plant. Consequently, the matter was "allowed to drag," as Earl puts it. But in 1949 Mr. Grinols ran into a superintendent of one of the mines in his area, who wanted to buy treated ties. This mine official had heard of the Osmose Wood Preserving Process and experimented on a number of ties. The simplicity and proven effectiveness of the treatment convinced him that Osmose Treated ties were the answer to reduced costs in his mine.

Upon inquiring, Mr. Grinols discovered that he could treat railroad ties with the Osmose Treatment for a tiny fraction of the cost of any other method and that it wasn't necessary to invest in a complicated plant to do so. Any species of green or water-soaked wood can be used and treating solution can be applied by spray or dip method. The Grinols Company immediately set up a modest treating tank at their Bemidji sawmill and found many ready customers. Last year when they started getting orders for thousands of ties at a crack they had to install the system shown above. Since then, they have tapped the huge farm market and are now producing treated Tamarack fence posts which are sold through their exclusive sales agents in Minneapolis.

If you own a sawmill and would like full details on how you can cash in on the ever-expanding market for treated railroad ties, mine timbers, fence posts and lumber without making a big investment, write to John L. Surdam, Vice President and General Manager, Osmose Wood Preserving Co., 980 Ellicott Street, Buffalo, N. Y.

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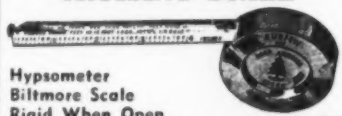

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R. Vance Miles to Head Southern Pulpwood Conservation Assn.

R. Vance Miles, Jr. of Gulf States Paper Corp., Tuscaloosa, Ala., was elected president of the Southern Pulpwood Conservation Assn. at the association's annual meeting in Atlanta, Jan. 19 and 20. He succeeded C. H. Niederhof of the West Virginia Pulp and Paper Co., Charleston, S. C.

Kenneth S. Trowbridge of North Carolina Pulp Co., Plymouth, N. C., was elected vice president. Henry J. Malsberger was reappointed as forester-manager of the association.

The meeting, one of the largest in the association's history, attracted a record attendance of 400 members and guests.

H. B Campbell Succeeds R. R. Macartney as Weyerhaeuser Branch Manager

R. R. Macartney, manager of Weyerhaeuser Timber Company's Klamath Falls, Ore., branch for 27 years has retired. He will be succeeded by Hugh B. Campbell, assistant branch manager since 1938.

Mr. Macartney's career, in addition to his part in the growth of company operations has included service on the lumber code authority of the NRA (1933-35); president and director, Western Pine Association; and president and board chairman, National Lumber Manufacturers Association. He is currently chairman of the board of N.L.M.A. He was instrumental in the start of the tree farm movement in the West.

Mr. Campbell is a forestry graduate of the University of Minnesota and he has worked in the Pacific Northwest since 1914.

A. M. Williams, J. T. Hemenway Assume New Positions

In the January issue of the JOURNAL it was announced that Alfred M. Williams, Jr., had been named secretary of both the Massachusetts Forest and Park Association and the New England Forestry Foundation.

It has been called to the attention of the JOURNAL that this news item, which also appeared in other publication media, was in error. Mr. Williams is secretary only of the Massachusetts Forest and Park Association and John T. Hemenway, formerly secretary-treasurer of the New England Forestry Foundation, will act as executive secretary of that organization. He will be assisted by J. Milton Attridge as chief forester. Mr. Attridge has been resident forester of the Monadnock Center in New Hampshire almost since its establishment, and will continue in that capacity in addition to his new duties.

A. B. Recknagel Retires

Arthur B. Recknagel retired as technical director of forestry for St. Regis Paper Co. on Dec. 31, 1953. However, he is continuing on a consulting basis with the company, and will assist in the scholarship program which it has established in forestry.

Mr. Recknagel assumed the position of technical director with St. Regis in 1947, after previous consulting work with the company. He has served as head of the Forestry Department at the University of British Columbia, Vancouver; area forester of the U. S. Forest Service; and professor of forestry at Cornell University, Ithaca, N. Y. He is a member of the S.A.F. and of the Forest Policy Committee and Forest Industrial Council of the American Pulp and Paper Assn. He is also the author of forestry textbooks and articles.

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Paul Schoen Joins N.C. Forestry Association

Paul Schoen has been named executive secretary of the North Carolina Forestry Assn. For the past two years he has been a private consultant in Washington, D. C., and was formerly affiliated with the Forest Farmers Assn., Atlanta, Ga., and the American Pulp and Paper Assn., Washington, D. C.

Timber Farmers Take New Headquarters

The Independent Timber Farmers of America officially changed its name from the Independent Forest Farmers on Jan. 1, 1954. At the same time the new organization composed of and controlled by individual forest owners and independent timber producers moved into new offices at 640 Lumber Exchange Building, Minneapolis.

I.T.F.A. is completing its first year. According to Charles H. Stoddard, its executive director, the objectives of the group include a system for current price reporting and market analysis, legislative representation in congress and state legislatures, educational work for improved forest practices as well as more efficient harvesting techniques, establishment of regional forest products exchanges similar to those for grain and livestock.

Already organized into local groups in a dozen states, I.T.F.A. makes provision for chartering and affiliating local forestry groups and associations already organized. A number of these are now affiliated. I.T.F.A. expected to open offices in Washington during the spring session of congress.

Southern Hardwood Producers to Meet March 4-5

Southern Hardwood Producers, Inc., will hold their annual meeting March 4 and 5 at the Roosevelt Hotel, New Orleans, and the National Lumber Exporters Association will meet in conjunction with the S.H.P.I. on March 4.

The second annual presentation of the "Hardwood Industry Man of the Year" award will be made at the meeting.

Announcement has also been made that the National Lumber Manufacturers Association committee on hardwood research administration will meet in connection with the S.H.P.I. The N.L.M.A. committee will gather to finalize a hardwood industry sponsored program for the coming year.

Tree Farms Over 30 Million Acres

As of January 1, 1954, American Forest Products Industries reports that 30,129,256 acres of privately owned timberland in the United States are included under its Certified Tree Farm Program. This is a total of 4,878 individual farms. Regional distribution of Tree Farms is as follows:

For the South, 2,572 Tree Farms totaling 17,925,526 acres.

For the West, 669 Tree Farms totaling 9,721,836 acres.

For the Lake States, 654 Tree Farms totaling 1,684,083 acres.

For the Central States, 344 Tree Farms totaling 182,792 acres.

For the Plains States, 158 Tree Farms totaling 39,960 acres.

For the East, 481 Tree Farms totaling 575,059 acres.

The largest Tree Farm is located in Florida and consists of the 800,000-acre property of the St. Joe Paper Co. It is located in 12 different counties.

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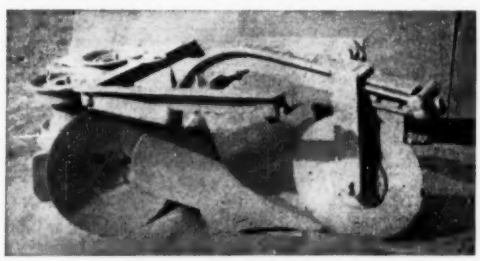

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As considerable time is required to process a change of address, you are urged to advise the JOURNAL as soon as you know your new address, preferably four weeks before the change.

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Government

Forest Service Annual Report Points to Effect of Forests on American Life

The vast resources of the national forests and their effect on the success of business enterprises and the economic and social well-being of thousands of American citizens and communities was pointed out by Richard E. McArdle, chief of the Forest Service, in his 1953 annual report to the Secretary of Agriculture.

A large part of his discussion of these resources is devoted to the management of the grazing resource because, it is emphasized, the agricultural economy of the West is inseparably linked with national forest ranges. They embrace the headwaters of major streams used for irrigation, hydroelectric power, domestic and industrial purposes. They also provide an important part of the summer forage, thereby forming a vital link in the year-round operation of the rancher.

The report covers accomplishments of the year in managing the water, timber, recreation, and wildlife resources on the national forests. Cash receipts from these and the grazing resources of the forest reached an all-time high of $76 million, exceeding operating and capital expenditures by nearly $12 million.

The report describes highlights of the cooperative programs carried on through the states and with private land owners, including fire control, on-the-ground technical assistance, and seedling distribution. It also covers research activities conducted by the Forest Service, most of them in cooperation with the state agricultural experiment stations, forestry schools, and forest industries.

In discussing national forest ranges, Mr. McArdle reports that about 4.1 million cattle and sheep graze western national forests under paid permit. These are owned by some 20,000 permittees who paid fees in 1953 totaling $4.4 million.

The total cumulative value of investments by the federal government

in range improvements totals about $3.5 million for reseeding and another $16.0 million for fence building, development of water places, stock driveways, and other improvements. In addition, grazing permittees during the past ten years have spent some $2.3 million for such range improvements and for revegetation. Other private contributions, worth about $650,000 annually, have been made in materials and labor.

Mr. McArdle's report describes actions this year which include: (1) changes in grazing policy to assure livestock producers of better tenure arrangements; (2) work toward revision of mining claims laws to keep spurious claims from interfering with timber management; (3) revision of policy in regard to federal sustained yield units; (4) programs under way to reduce timber losses from insect epidemics; (5) a study of national forest boundaries with a view to needed revisions; (6) work with the Interior Department aimed at settling controversy over administration of certain O & C—Forest Service lands in Oregon; (7) consolidation of national forest and regional offices and experiment stations; (8) organization of a Forest Research Advisory Committee.

Copies of the report may be obtained from the Forest Service, Department of Agriculture, Washington 25, D. C.

Jemison Succeeds Wyckoff at California Experiment Station

George M. Jemison was appointed director of the California Forest and Range Experiment Station effective Feb. 1, 1954. He succeeds Stephen N. Wyckoff, who retired from the Forest Service on that date after 35 years of service with the federal government.

GEORGE M. JEMISON

Dr. Jemison had been director of the Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mont., since June 1950. Prior to that assignment he was chief of forest management research at the Southeastern station at Asheville, N. C. He has also worked in the fire research field both in western and eastern United States. Dr. Jemison has held offices in both the Northern Rocky Mountain and the Appalachian sections of the Society, and was chairman of the latter section in 1946.

Mr. Wyckoff leaves the Forest Service after many years with the Research Branch. Between 1936 and 1954 he served as director of three western experiment stations.

Georgia Requires Performance Bond for Assistance

Woodland owners in Georgia are now required to post bond prior to receiving advice in forestry practices from the Georgia Forest Commission, according to Director Guyton De-Loach.

Before timberlands are marked, a deposit of 50 cents per M board feet

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and 13 cents per cord is required. The deposit is refunded if application is made prior to expiration of a 6-month period and after a commission forester has determined that the timber was cut according to the marking.

Management service is limited to four days for any one landowner.

G. L. Dimmick Retires

Guerdon L. Dimmick, Milwaukee, inspector in forest fire control for the U. S. Forest Service in Region 9, retired from government service Jan. 15.

GUERDON L. DIMMICK

For the past eight years, Dimmick has worked closely with members of state conservation departments in Michigan, Wisconsin, Minnesota, North Dakota, Ohio, Illinois, Indiana, Iowa, and Missouri in the promotion of improved fire fighting techniques and equipment. He also contacted manufacturers to interest them in making fire fighting equipment developed by foresters to meet special needs. His success in this work was recognized in 1953 by a superior service award bestowed on him by the U. S. Department of Agriculture.

Mr. Dimmick's interest in fire equipment stemmed from his experience as a camp superintendent in the C.C.C in Michigan in the 1930's at a time when forest fire control was handicapped due to lack of mechanized equipment.

Before joining the Forest Service in 1934, Dimmick was in real estate and building construction work in Detroit for eight years. Between 1919 and 1924 he was general manager for the Michigan Highway Motor Bus Company and the Eastern Michigan Motor Bus Company in Detroit.

He is a forestry graduate of Michigan State College and served in the Army in World War I. He is a member of the S.A.F.

Anderson Becomes Chief, U.S.F.S Personnel Division

Bernard A. Anderson, formerly assistant regional forester in charge of personnel for the Pacific Northwest region of the Forest Service, has been appointed chief, Division of Personnel Management, Forest Service. He succeeds H. Dean Cochran, who has become regional forester for the North Central region.

Melis Appointed to Bureau of Indian Affairs Post

Percy E. Melis, of Window Rock, Ariz., has been appointed chief, Branch of Forest and Range Management, Bureau of Indian Affairs. He succeeds Leroy D. Arnold. Mr. Melis has been forester in charge of range management in the Window Rock area since July 1952. Before taking that position, he held various positions in the Indian Bureau and the Forest Service.

Harry W. Dengler Honored For Forestry Interests

Harry W. Dengler, of the University of Maryland extension service, was presented with a watch "for outstanding services," at the annual

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fall meeting of the Holly Society of America, Inc., at Rutgers University, Nov. 13, 1953. He had served two two-year terms as vice president and secretary-treasurer of the organization.

In January Mr. Dengler was honored again when he was selected as one of the ten honorary vice presidents of the American Horticultural Society, Inc., in "recognition of his interests in forestry and horticulture."

C. A. Joy Succeeds Walt Dutton as Range Management Chief

Charles A. Joy, assistant chief of the Division of Range Management, U. S. Forest Service, has been appointed to succeed Walt Dutton as chief of that division. Mr. Dutton has retired after 40 years of federal service and is accepting an assignment with the British government as range consultant for African colonies.

Drop in Man-Caused Fires on National Forests

Man-caused fires on national forests dropped 14 percent during 1953—from 7,001 in 1952 to 5,960 in 1953, the Department of Agriculture has announced. The total number of fires on national forests remained about the same—11,950 for 1953 as compared to 11,955 for 1952.

The decrease in fires caused by human carelessness is commendable, Forest Service officials believe, because of the severe drought and extreme fire hazard during the past year in many parts of the country at times when many people were using the woods. Under such conditions, past studies show, forest fires may be expected to increase in spite of precautions.

The decrease in man-caused fires in 1953, the Forest Service says, was largely because of the nation's increased awareness of forest fire dangers, helped by the Smokey Bear forest fire prevention campaign conducted by state and federal forest services under sponsorship of The Advertising Council, and the Keep Green programs conducted by forest industries and the states.

Education

Col. Greeley Lectures at Oregon State

Col. William B. Greeley visited Oregon State College Jan. 25 to Feb. 20 as a special lecturer in the School of Forestry. In addition to the student lectures and seminars, he was scheduled for several faculty conferences and public addresses, according to Dean Paul M. Dunn of the school.

Earlier in the year he presented a series of special lectures at Yale University. The Colonel's two recent books, *Forests and Men*, and *Forest Policy*, have gained wide attention.

Marlin H. Bruner Joins Clemson College Staff

Marlin H. Bruner, formerly manager of the southern district of the extension division of E. I. DuPont de Nemours Co., joined the forestry staff of Clemson College on Jan. 1. He will work with forestry, wildlife and recreational activities on the Clemson land use area.

MARLIN H. BRUNER

Mr. Bruner received his B.S. degree in forestry from Pennsylvania State College in 1931 and his M.F. degree from Yale University in 1932. He has previously taught forestry and done extension work at the University of Arkansas, and served as extension forester at Clemson, before joining DuPont in 1942.

Weyerhaeuser Fellowship Awarded at Oregon State

David F. Keiser of Corvallis has been awarded the Weyerhaeuser fellowship in forestry at Oregon State College for 1953-54.

Announcement of his selection for the $1,000 award came from Paul M. Dunn, dean of forestry. The fellowship is sponsored annually by the firm to encourage graduate study and research in forest management.

A 1950 graduate of Pennsylvania State College, Keiser worked with a private forestry corporation in Lewiston, Idaho, and with the U. S. Forest Service before coming to Oregon State. He was a timber sales officer on the Ochoco national forest and was granted leave of absence to do advanced study. During the summer of 1949, he worked for the Juneau Spruce Corporation in Fairbanks, Alaska.

Keiser is a veteran of both World War II and Korea. He served with the navy from 1943 to 1946, and was with the marines in Korea from November 1950 to December 1951.

His thesis project will be on conk rot with emphasis on development of practical applications in cruising defective timber stands.

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Laval Univ. Inaugurates Genetics Course

The Faculty of Surveying and Forest Engineering of Laval University, Quebec, Canada, has announced the commencement of a course in forest genetics. Lectures will be delivered by Dr. Levi Chouinard who is a graduate of the university, with post-graduate studies at the University of Wisconsin in the field of cytology and genetics.

This is the first Canadian forestry school to offer this subject to undergraduates, according to the announcement, and it is being started in anticipation of the importance of the subject in future Canadian forestry work.

Third Forestry Symposium To Be Held at L.S.U.

The School of Forestry at Louisiana State University has scheduled its Third Annual Symposium for April 8 and 9, 1954, to be held on the L.S.U. campus. The subject for discussion this year will be "Recent Developments in Planting and Direct Seeding in the Southern Pine Region."

About a dozen technical papers will be presented in three half-day sessions. The first session will cover direct seeding, the second planting stock and policy; and the third, the actual job of plantation establishment and management. Announcement of speakers, subjects, and moderators will be made as soon as program plans are completed.

For further details concerning the symposium contact the program chairman, Prof. M. B. Applequist, School of Forestry, Louisiana State University, Baton Rouge.

Allied

Journal of Range Management Gets New Look

The American Society of Range Management has revamped their bimonthly publication, *Journal of Range Management*. Beginning with the January issue, Vol. 7, No. 1, it appears in new 3-column pages of 8½ by 11 inches size. Previously its pages were 2-column, 6 by 9 inches. Editor Robert A. Darrow indicates the intentions of the society to increase advertising and to expand their News and Notes section. He also indicates plans to broaden subject matter scope by the inclusion of articles of international importance. Their new journal is a distinct credit to the American Society of Range Management.

Goals for 1954 National Wildlife Week

Cleanup of water pollution will be stressed during the 1954 observance of National Wildlife Week, March 21-27. Although the general goal of the nation-wide educational campaign will be the same as in previous years—simply to get more people concerned about natural resource problems—the National Wildlife Federation has listed six specific objectives in connection with the 1954 theme:

1. Promotion of adequate water pollution laws in every state.
2. Adequate appropriations for state pollution control agencies.
3. Adequate sewage treatment facilities in every community.
4. Adequate waste prevention or waste treatment by every industry.
5. Prevention of silt pollution through soil conservation practices.
6. Adequate appropriations for research and cooperative programs of Water Pollution.

In stating the six objectives, the federation recognized that the national pollution problem is a long-range program.

National Wildlife Week has been sponsored annually since 1938 by the National Wildlife Federation and

Distinctive Membership Emblems Available

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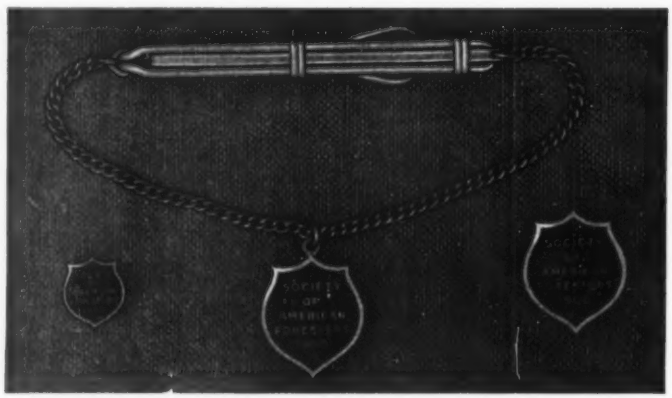

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THE EMBLEMS pictured above in actual size are 10K gold, with gold letters on a dark green background surrounded by a gold border. All grades of members are eligible to wear these emblems. Order the style you prefer from:

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825 Mills Bldg., 17th St. and Pennsylvania Ave., N. W.
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state affiliates. Ed Dodd, the creator of "Mark Trail," will serve again as national chairman. Local chairmen will assist him in every state.

Forest Products Research Society to Hold Meeting in Grand Rapids

Forest Products Research Society will hold its eighth national meeting in Grand Rapids, Mich., May 5-7, simultaneously with the "1954 Woodworkers' Industry Show", and will cooperate closely in integrating its meeting with that of the woodworking industry.

Dr. J. Alfred Hall, U. S. Forest Products Laboratory; L. J. Carr, L. J. Carr Lumber Co., Sacramento, Calif.; and Prof. Fred E. Dickinson, University of Michigan, are, respectively, general chairman, technical program chairman, and operating chairman of the F.P.R.S. meeting.

The F.P.R.S. meeting will be divided into eight sessions: packaging, wood composition board; wood machining; wood drying; glues and gluing; wood finishing; quality control; and a general meeting.

Photogrammetrists Meet

More than 1,000 persons attended the 20th annual meeting of the American Society of Photogrammetry, Jan. 13-15, in Washington, D. C. Both civilian and military personnel participated in technical sessions covering a wide range of subjects directly related to the use of aerial photographs for map making, or contributing to, or benefiting from this use.

American Congress on Surveying and Mapping

American Congress on Surveying and Mapping will hold its annual meeting and exhibit March 22-24, 1954, at the Hotel Shoreham, Washington, D. C. Non-members are invited to attend. Information may be obtained from Oscar Nelson, Room 6212 G.S.A. Building, U. S. Geological Survey, Washington 25, D. C.

New Transplanter Announced

A fully mechanical two-row precision transplanter that will handle over 20,000 plants per hour has been announced by the newly formed Eleo Products Corp., of West Allis, Wis., headed by Harvey F. Ludwig, former vice-president of M-E Rotary Tillers.

The transplanter is drawn by any medium tractor such as a Ford or Ferguson and is manned by 2 to 6 men

What do you think?

Among all the improvements pioneered by Southern Glo in the past decade and a half, none was more revolutionary than the stay-mixed formula #71020, introduced last year.

So successful is this formula that Southern Glo Ready-mix Tree Marking Paint now is available in a flat can with pouring spout, as well as the conventional round container.

Southern Glo Paste, produced by the same formula, mixes readily to desired consistency, without waste of time or material.

Both give a highly visible mark—a paint that does not clog your gun or settle out in storage.

With Southern Glo Boundary Marking Paint, third of these professional products, your mark is easy to apply, stays visible for years.

Tested and compared in the field and in the laboratory,—against itself and with competitors,—produced by the best equipment,—Southern Glo today is the best that experiment and experience can produce.

—And all this,—at the going price for tree marking paints which, you recall, began as an economy measure!

But the product that stands still can't stay ahead. To keep Southern Glo abreast of your changing practices, we come directly to you: How could Southern Glo increase its value to you? Your comments will continue to shape our products.

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Dept. M-2, Sumter, South Carolina

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

POSITION AVAILABLE

Osmose Wood Preserving Co. of 980 Ellicott St., Buffalo 9, New York has openings for permanent work with excellent remuneration in pole inspection and brush control. Travel is necessary.

Please write Utilities Division for information.

Positions Wanted

Forester, B.S.F., 1950. One year logging and management experience in Lake States, eight months photogrammetric mapping, and eight months surface-water investigation experience in Northeast. Veteran, married, one child. Desire logging or forest management employment in Lake States or Northeast.
Box B, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F. Pennsylvania State College, desires job in forest management or woods supervision. Experience includes forest management, timber marketing, and logging. Also two years experience in military cartography. Age 27, married, three children. Salary important but secondary to job offering challenge and opportunity.
Box C, Journal of Forestry, Mills Building, Washington 6, D. C.

1951 graduate of forestry (B.S.F.) and degree in Business Administration, fully experienced in all phases of the forest industry, including logging, sawmilling, plywood manufacturing, and government forestry, seeks responsible position preferably in Pacific Northwest or California. Married, age 30, S.A.F. member. Excellent references and detailed information upon request.
Box D, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester desires position in timber and log buying and cruising in the Western Pine Region. Graduate State College of Washington, degree in Agriculture, majoring in Forestry. Three years experience with U. S. Forest Service and private industry. Age 38, married, two pre-school age children. Ex-G.I.
Box E, Journal of Forestry, Mills Building, Washington 6, D. C.

Teaching position desired in New England, Middle Atlantic, or Southeastern states. Best qualified and most interested in silviculture, fire protection, timber management, and wildlife management. Willing to work in any forestry or conservation field. Also interested in research. Experience in East and West. Currently with federal government. Age 33, married, three children. B.S. and M.F. degrees.
Box F, Journal of Forestry, Mills Building, Washington 6, D. C.

Forest manager, now employed in the Pacific Northwest. Several years basic field experience, inventory, cruising, engineering, regeneration, and protection. Supervisory field experience, six years, engineering, road construction, management, Douglas-fir thinnings, salvage, logging contracts, and costs. Administrative experience, five years, company management, budgets, costs and reports. Desire opportunity with company operating own mills, and looking forward toward future management of second-growth Douglas-fir and hemlock stands. Excellent references.
Box G, Journal of Forestry, Mills Building, Washington 6, D. C.

who feed the transplants into a conveyor belt of mechanical fingers. Transplanting is fully automatic from this point on—the plants are gently but firmly carried down into the freshly opened furrow and actually planted in the soil as they would have grown from seed. When the rubber-clad fingers release the plant directly behind the specially designed plow, a turbulating action of the soil spreads the roots and additional soil rushes in to cover the root system. The packing wheels immediately pack the soil firmly around the plant, releasing all air.

Row width on the new Elco transplanter is adjustable from 18 to 60 inches, and plant spacing is adjustable from 3 to 72 inches in the row in multiples of 3 inches, all at normal tractor speed. It will handle plants from 4 to 20 inches long. An attachment for synchronized watering and fertilizing is available.

The Elco transplanter is approximately 72 inches square and 40 inches high and is equipped with a specially designed yoke hitch that does not require a hydraulic power lift on the tractor. It is fully equipped with tapered roller bearings with dust seals, and all gears run in oil baths. Bearings are hermetically sealed with no grease nipples. Wheels have pneumatic tires for easy transportation behind tractor, truck, or passenger car.

New One-Man Chain Saw

After extensive field tests a new one-man chain saw has been placed on the market by Poulan Chain Saws, Shreveport, La. The cutting attachments for the new saw are 16-, 21-, and 26-inch beaver tail blades and 15- and 20-inch bows. In addition to this new one-man chain saw, the Poulan Company manufactures two-man saws in 11 sizes: bow attachments from 18-inch to 33-inch, and straight blades from 24-inch to 74-inch. Both saws feature gear drive, recoil and rope starter, automatic lubrication, visible fuel level, automatic clutch, screened cylinder, magneto points easily accessible. Guides are reversible on the straight blade saw and entire length of guide is hard surfaced. The bow saw has return idling wheels, new type chain tensioner and the weight of the motor is above the cut.

Forester, 43, married, family. B.S. Conn., 1934; M.F. Yale, 1946. Desires position with wood-using industry or wood broker; preferably in Northeast, Lake States, or Ohio River region. Over twenty years experience in federal, state, and private forestry, including administration, management, public relations, teaching, and research. Emphasis principally on management and utilization.
Box H, Journal of Forestry, Mills Building, Washington 6, D. C.

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Gets **a lot of work done** for its size!

Wide furrow in one trip in third gear – a Cat D2 Tractor with fire control plow working for the Southern Advance Bag & Paper Co., near Jonesboro, La. Other rugged yellow units in the company's line-up: a D7, three D6s, ten D4s and two D2s.

THERE's a lot of power packed in this compact Cat* D2 Tractor, one of a fleet of yellow rigs used by the Southern Advance Bag & Paper Co., Hodge, La. This company uses these tractors on the logging, clearing, planting and fire control jobs required in the intensive forest management of its 148,000 acre holdings. Here the D2 pulls a fire control plow in a timber management area near Jonesboro. Depending on soil conditions, the unit throws a wide furrow in one trip in third gear. Equipped with a tree planter, the D2 plants about 1½ acres of pine per hour in good going. With either attachment, it's easily trucked from area to area.

Power alone doesn't account for the D2's ability to get a lot of work done. That power is *matched* with weight and traction for maximum pull. Just as important, *all* parts of this rig are strongly built to keep it on the job and out of the shop—another factor in good production. An example of construction: track rollers and idlers are sealed to keep mud and dust out, and oil in, for longer wear. Another example: track shoes are made of rolled steel, heat treated for long life. All these and other details pay off in *more* work at *lower* cost with *less* down time than any competitive unit!

It pays to standardize on Caterpillar equipment, too. Why? Many parts are interchangeable. Operators and mechanics become familiar with one line. Result: operators get out all the work built into the machines. And mechanics service them easier, faster. There's also considerable saving in one-stop service from one dealer —your Caterpillar Dealer.

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Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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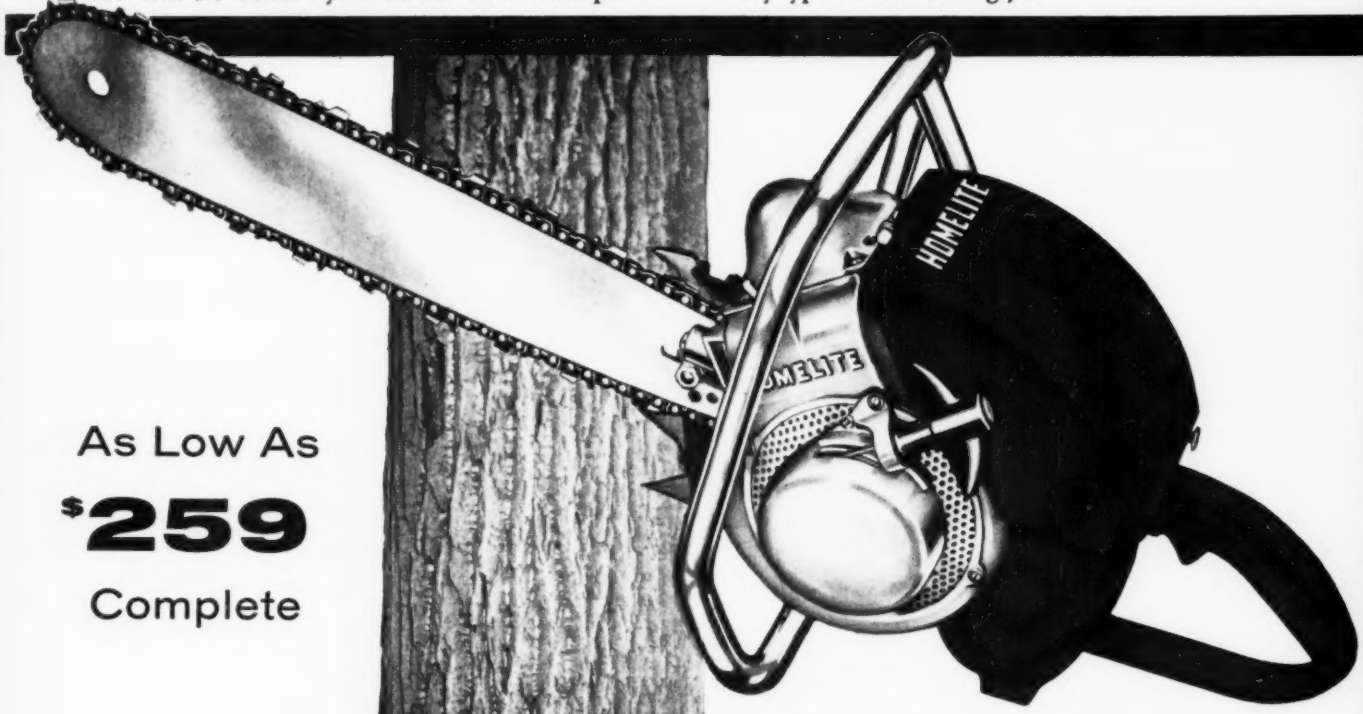

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